2015 OSIsoft TechCon

Geospatial Analysis
in Real Time

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Introduction

"The ArcGIS Online Organization subscription configured in this lab has expired. However you can work on this lab using your own organization in ArcGIS Online. If you are not a member of an existing organization, you can get a 60 day free trial: http://www.arcgis.com/features/free-trial.html?origin=arcgis"

This session explores the newly formed partnership between Esri's ArcGIS powerful mapping platform and the real-time PI System infrastructure. In this session, you will discover how easy it is to connect your PI System to your Esri ArcGIS platform to create an operational view of critical metrics on your enterprise in a geospatial way. You'll be guided through a few different scenarios to discover the power of real-time data in a mapped world. Together, we will explore Esri's ArcGIS platform and discover how to use Esri's Operations Dashboard for ArcGIS client to create insightful map-based dashboards of live PI System data. You'll also create valuable calculations through your PI AF Server, and you'll learn how to launch integrated PI Coresight displays from Esri maps to drill down into your data.

We have prepared an environment for you that represents a typical site that has both a PI System and the Esri ArcGIS platform installed. Specifically, you will each have access to a pair of virtual machines, one running a self-contained PI System—including the new PI Integrator for Esri ArcGIS—and another virtual machine that runs an the Esri ArcGIS platform, including the required GeoEvent Extension. You will use these two machines to walk through the workflow of creating a dashboard with a live map, populated with live data from the PI System.

Regarding the two virtual machines that you'll be using: on the OSIsoft side, we've installed the PI System 2014, which includes both the PI Data Archive and the PI Asset Framework. Additionally, that machine is running PI Coresight 2014, for visualizing data. We've preinstalled the PI Integrator for Esri ArcGIS for you as well—and finally, in order to make using the Integrator easier, we have preloaded a PI AF Database for you that already contains PI AF Templates, in addition to preloading all of the required PI points as well, and the requisite simulated data for the scenario.

On the Esri side, on that VM we have installed ArcGIS Server 10.2.2, along with GeoEvent Extension for Server 10.2.2, and finally, Esri's Operations Dashboard, the free Esri client tool that will be used at the end to create a custom dashboard.

Your instructors will inform you how to access these machines; after you have access to them, as a class you'll be guided through the following steps:

1. Verify that the requisite configuration steps have been performed on the GeoEvent Extension and on the PI Integrator for Esri ArcGIS Application Server
2. Verify that the PI AF Database is ready for use (that it contains properly structured PI AF Element Templates, and that data for all of the Elements is updating properly)
3. Create a Service and two Layers via the PI Integrator for Esri ArcGIS Application Server, one Layer for static (immobile) Elements and one Layer for mobile Elements

4. Create a new Feature Service and Configure the GeoEvent Extension via the ArcGIS Platform Wizard
5. Create a new ArcGIS Online Web Map to display the newly created Feature Service
6. Add PI Coresight integration to the ArcGIS Online Web Map
7. Create a custom dashboard around that Web Map, using Esri's Operations Dashboard

If you ever have any questions, feel free to ask an instructor. Additionally, you can find the user guide at the OSIsoft Live Library (livelibrary.osisoft.com), under **Integrators** > **PI Integrator for Esri ArcGIS**.

Below is are the names of the machines that you can use for this class, along with the credentials that you'll use for signing into them and arcGIS Online. We've included the names and credentials twice, and we recommend tearing out one of the below sections from the book and keeping it close so you can be quickly reminded of what credentials and machine names to use.

"The ArcGIS Online Organization subscription configured in this lab has expired. However you can work on this lab using your own organization in ArcGIS Online. If you are not a member of an existing organization, you can get a 60 day free trial: http://www.arcgis.com/features/free-trial.html?origin=arcgis"

Windows Credentials	
Username	Nugreen\PISandboxAdmin
Password	0nc3Inawhil3!
ArcGIS GeoEvent Extension Credentials	
Username	arcgis
Password	arcG1$88
ArcGIS Online Credentials	
Username	User____ (your name will be User001, User002, etc.)
Password	osisoftesri1
Servers	
PI Server Name	PI1

ArcGIS Server Name	GEP1
Integrator Application Server	https://pi1.nugreen.org:6443/pigeoportal
GeoEvent Extension Manager	https://gep1.nugreen.org:6143/geoevent/manager

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Tear out this page and keep it nearby as a handy reference.

Windows Credentials	
Username	Nugreen\PISandboxAdmin
Password	0nc3Inawhil3!
ArcGIS GeoEvent Extension Credentials	
Username	Arcgis
Password	arcG1$88
ArcGIS Online Credentials	
Username	User____ (your name will be User001, User002, etc.)
Password	osisoftesri1
Servers	
PI Server Name	PI1
ArcGIS Server Name	GEP1
Integrator Application Server	https://pi1.nugreen.org:6443/pigeoportal
GeoEvent Extension Manager	https://gep1.nugreen.org:6143/geoevent/manager

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1. Verify that Prerequisites and Configuration Steps are Complete

We have already installed all of the required software components for you, and after doing that, we have completed the prerequisite configuration steps on both the ArcGIS GeoEvent Extension and the PI Integrator for Esri ArcGIS.

The steps that we have already completed for you are:

1. Trust certificates for the GeoEvent Extension and for the PI Integrator for Esri ArcGIS
2. Install the PI Integrator for Esri ArcGIS Data Relay and verify that it is communicating with the PI Integrator for Esri ArcGIS Application Server
3. Register at least one PI Coresight Server endpoint in the Application Server
4. Register at least one ArcGIS GeoEvent Extension endpoint in the Application Server
5. Register at least one valid Data Store on the GeoEvent Extension *(you'll finish this yourself).

We'll together walk through those configuration steps, even though they are already finished, so that you'll be familiar with what will need to be done on a completely new installation.

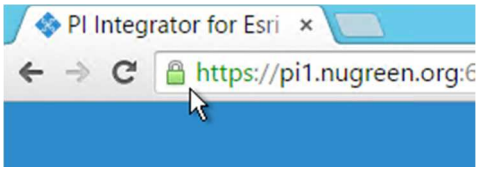
1. Trust certificates for the GeoEvent Extension and for the PI Integrator for Esri ArcGIS

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

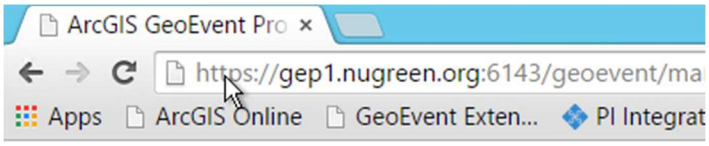
Both the PI Integrator for Esri ArcGIS Application Server and the ArcGIS GeoEvent Extension web sites use HTTPS, and thus, if their certificates aren't trusted, if you try to navigate to either web page, you will see a security error, informing you that the certificate isn't trusted.

You can use the web browser that is installed on the PI Server machine, which is called PI1; from here on out, all of your work will be done from this machine.

The documentation for both the PI Integrator for Esri ArcGIS and for the ArcGIS GeoEvent Extension describes how to trust that certificate; we have already gone through that process for you. To verify that those certificates are indeed trusted, you should open the PI Integrator for Esri ArcGIS Application Server and make sure that the browser address bar shows a lock icon, confirming that the certificate is trusted (or at the very least, you should *not* see a red security error).



Repeat that check using the URL for the ArcGIS GeoEvent Extension Manager; it should be a bookmark in your web browser address bar.

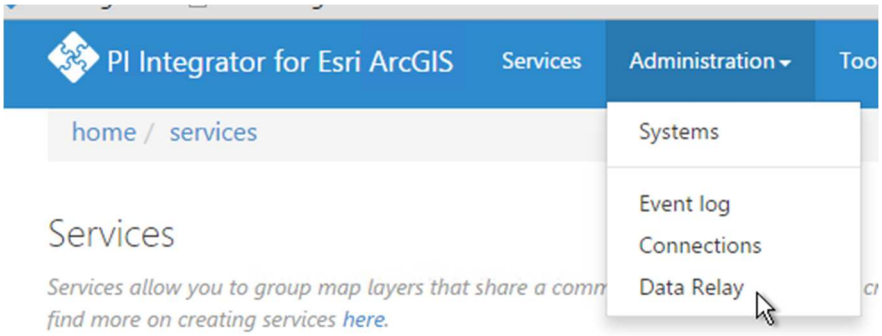


2. Install the PI Integrator for Esri ArcGIS Data Relay and verify that it is communicating with the PI Integrator for Esri ArcGIS Application Server

The PI Integrator for Esri ArcGIS Data Relay (which we have already installed) is a data client that runs on a computer located within your network. It provides data to the PI Integrator for Esri ArcGIS Application Server. When that Application Server is hosted on-premises (as it is in our case), the Data Relay sends PI data across your local network to the Application Server. In the following steps, we will together verify that the Data Relay can indeed connect to the Application Server.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

1. Log in to PI Integrator for Esri ArcGIS Application Server by navigating to, for example, https://pi1.nugreen.org:6443/pigeoportal. It should be a bookmark for you in your web browser; consult the handy credential tear-out sheet (page 8) from earlier for credentials.
2. Navigate in the Application Server to the **Administration** > **Data Relay** page



3. Verify that the following message displays:

```
Your Data Relay is running on node 'node_name'
```

If this message indeed appears, then your Data Relay Service is indeed properly communicating with your Application Server.

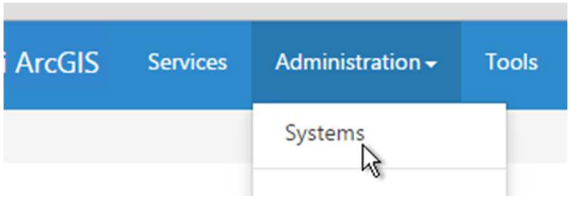
3. Register at least one PI Coresight Server endpoint in the Integrator Application Server

The PI Integrator for Esri ArcGIS Application Server allows a DisplayServer link to be generated for each Layer that is created in the Application Server. That link allows an ad hoc PI Coresight display to be automatically generated for a specific Esri map Feature. For example, if this link is used in a Feature pop-up, when a user clicks on a particular Feature, then clicks on the DisplayServer link, the identifying information for that particular clicked Feature will be passed to the PI Integrator for Esri ArcGIS Application Server, and the user will be redirected to an automatically generated ad hoc PI Coresight display, containing a trend that shows all of the PI AF Attribute data for that specific map Feature.

In order for this functionality to work, a PI Coresight server must be registered in the Integrator Application Server; moreover, that PI Coresight server must have access to the PI AF Element data that corresponds to the Esri Features in question. For example, if a Layer was created from a PI AF Element Template for trains, then the PI Coresight server should allow access to the PI AF Element database that contains those train Elements. In our case, we have already registered a PI Coresight server for you, so we'll check now to show you what that should look like.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

1. Open the PI Integrator for Esri ArcGIS Application Server and log in.
2. Select **Administration** > **Systems**.



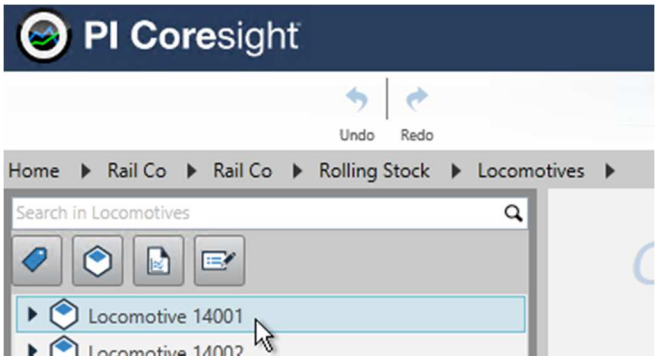
3. If no PI Coresight servers were defined previously, the following message displays:

   You don't have any PI Coresight servers registered. Click here to add one.

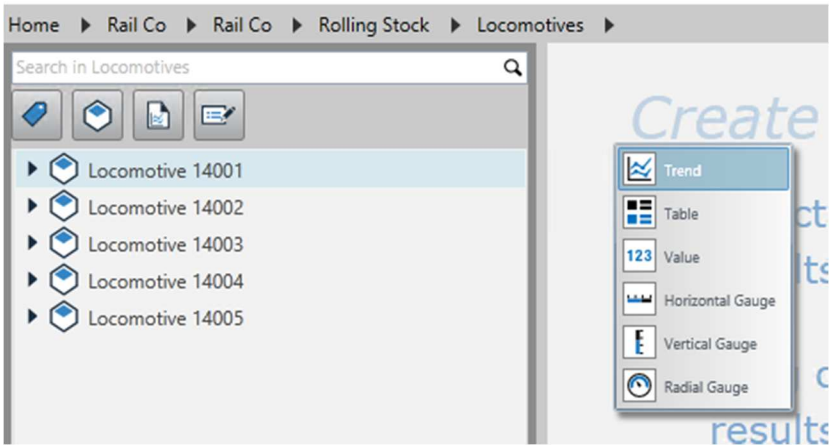
   In our case, since at least one PI Coresight server has already been defined, it will appear; additional servers will be listed alphabetically on the page.

4. Click on the URL for your registered PI Coresight server in order to launch PI Coresight.
5. Log into PI Coresight using your Active Directory credentials.
6. Verify that you can manually create a PI Coresight display that contains data for the PI AF Elements that will make up your Esri map Layer. Specifically, click **New Display:**

   Then in the search pane, navigate (click the ▶ triangle icons in PI Coresight) to the item **Rail Co** > **Rail Co** > **Rolling Stock** > **Locomotives** > **Locomotive 14001**.



Click on **Locomotive 14001** and drag it onto the display canvas on the right, and select that you want the data to be shown as a **Trend**.



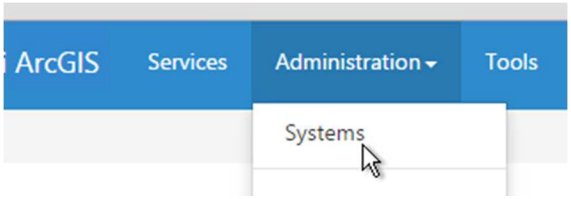
If you can successfully complete this step, you will get a trend of real-time data, and we can safely proceed to the next step.

4. Register at least one ArcGIS GeoEvent Extension endpoint in the Application Server

The PI Integrator for Esri ArcGIS communicates with the ArcGIS GeoEvent Extension; we have already registered it for you, and now we will again check to show you what that looks like.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

1. Open the PI Integrator for Esri ArcGIS Application Server and log in.
2. Select **Administration** > **Systems**.



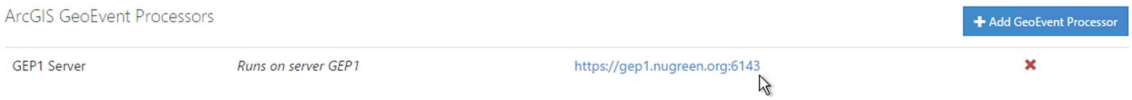
3. If one or more ArcGIS GeoEvent Extension servers have been defined (which in our case, is indeed true), they are listed alphabetically on the page.

   The URL should have the following format:

   ```
   https://server:port
   ```

   For example:

   ```
   https://gep1.nugreen.org:6143
   ```



   You can test that this URL is correct by copying it into your browser and appending "geoevent/manager"; the final URL should look like this:

   ```
   https://gep1.nugreen.org:6143/geoevent/manager
   ```

   If the URL resolves to the GeoEvent Extension login screen, then you've indeed successfully registered your GeoEvent Extension endpoint. Please make sure that there are no certificate errors.

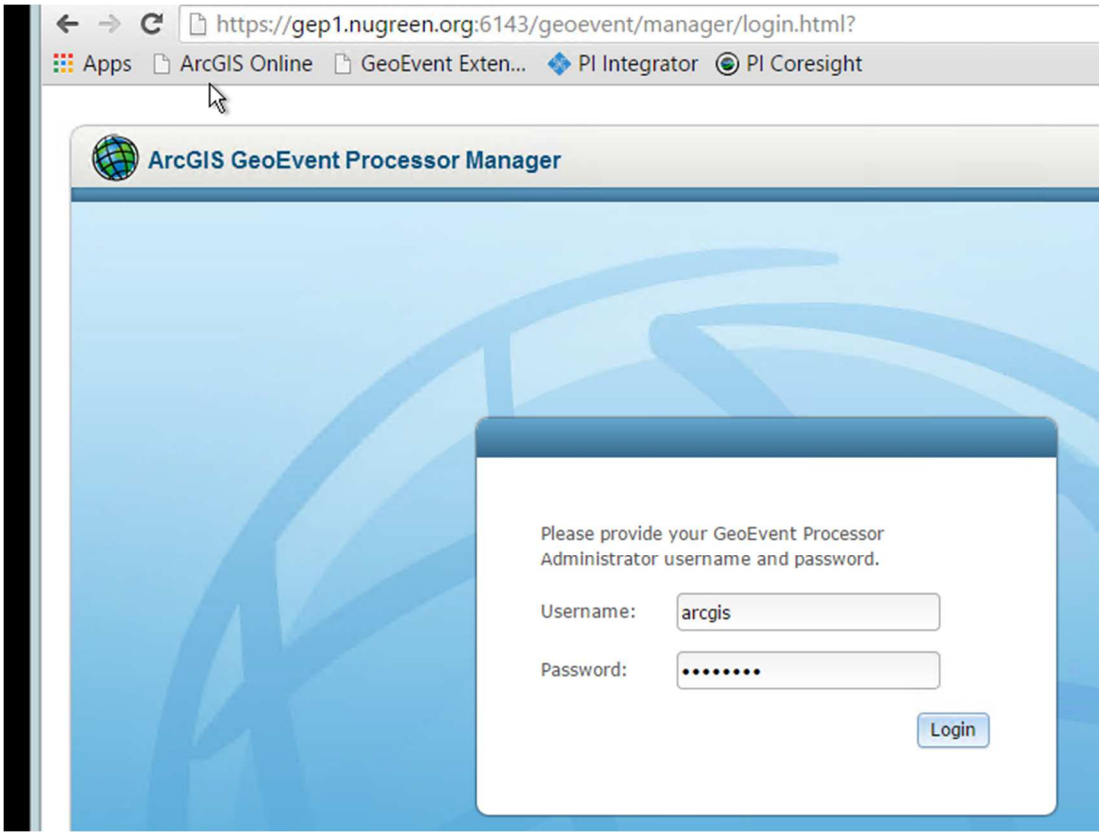
5. Register at least one valid Data Store on the GeoEvent Extension

The live-updating Esri Feature Services that we create through the Integrator will be created within an ArcGIS Account, either an ArcGIS Online account or a local ArcGIS Server account (in this case, we're using ArcGIS Online). The GeoEvent Extension, therefore, needs access to that account, so that it can write data to those Feature Services. Access to that account is allowed by registering it as a Data Store on the GeoEvent Extension. Here you will actually set up a Data Store yourself, for your own unique ArcGIS Online account.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

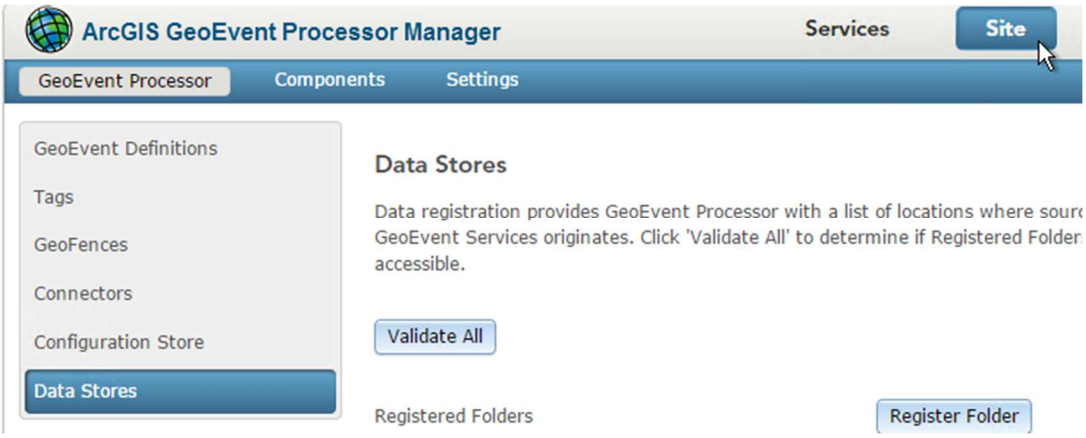
1. Sign into your GeoEvent Extension manager; a link should already be in the bookmarks bar of your web browser. The URL should be of the form:

   https://gep1.nugreen.org:6143:6143/geoevent/manager



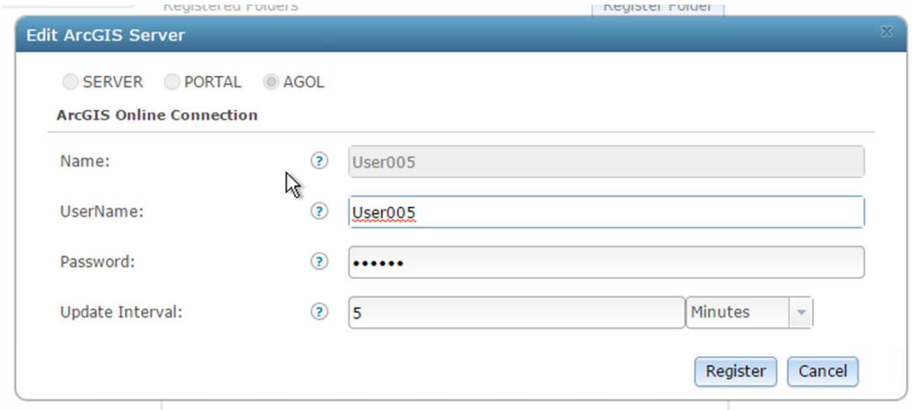
   Use the credentials provided on the handy credential tear-out page on page 8.

2. Navigate to **Site** > **GeoEvent** > **Data Stores**



3. You should see, under **Registered ArcGIS Server**, the button **Register ArcGIS Server**; go ahead and click it, which will allows us to begin adding a Data Store.

4. Select that the Data Store type is **AGOL** (ArcGIS Online), and enter in the ArcGIS Online Username and Password (both are *case-sensitive*) that was provided to you. Leave the Update Interval at its default value.



5. Click **Register**, then click on the **Validate All** button.

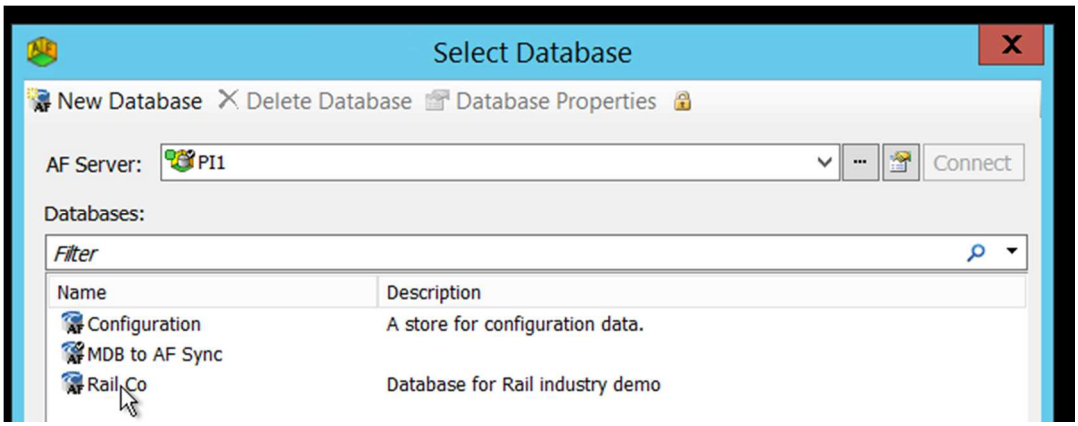
If a green check-mark appears next to your Data Store, then you're all ready to proceed to the next section.

2. Verify that the PI AF Database is ready

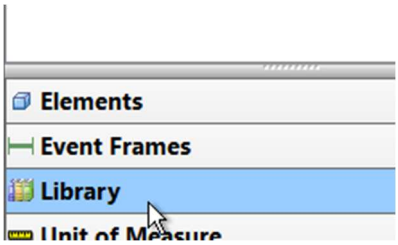
We have loaded a PI AF Database for you that already contains Elements, based on PI AF Element Templates (which are required by the PI Integrator for Esri ArcGIS), for both moving and static assets. We are going to examine what we have created for you. Note: please do *not* make any changes to this PI AF database; after the class is over, feel free to ask us about possible alternatives, but during the exercises, we'd ask that you please leave the AF database unchanged, so that the exercise can be identical for all involved—and so that the workbook instructions will stay relevant.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

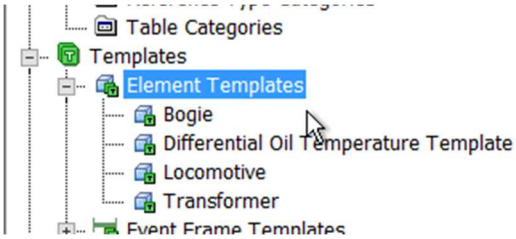
1. Open PI System Explorer, and connect to the AF Database called **Rail Co**.



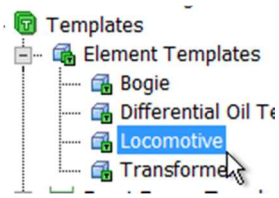
2. We'll start by looking at our Element Templates. Via the navigator pane in the lower left, select **Library**.



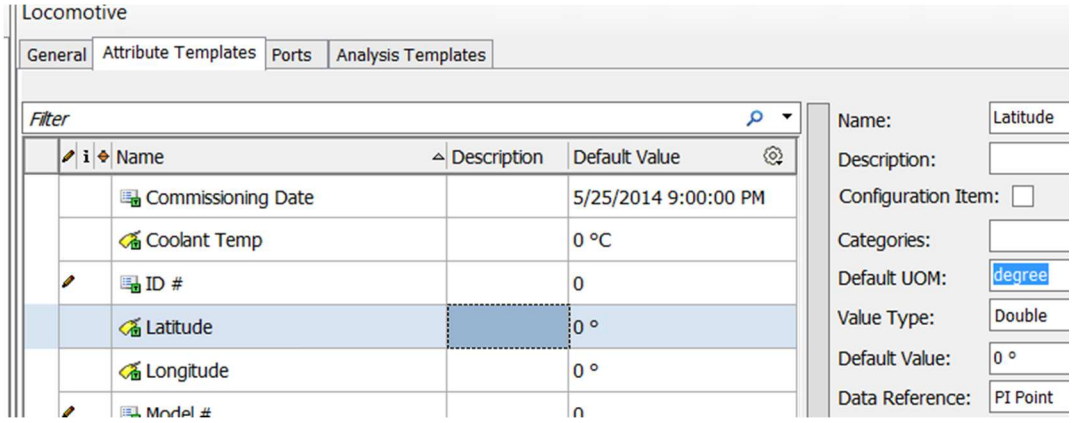
3. Browse to **Element Templates**. We've created four Templates for you, two of which are tradition Templates, and two of which are Templates suited for use with the PI Integrator for Esri ArcGIS. What distinguished the two? Here's a hint: in order to visualize a PI AF Element on a map, you must know the location of the Element, which must be stored as an AF Attribute (or multiple Attributes…).



4. Examine one of the two Templates that we'll use to create a live-updating Esri Feature Service; click on it, and then on the right, click the **Attribute Templates** tab.

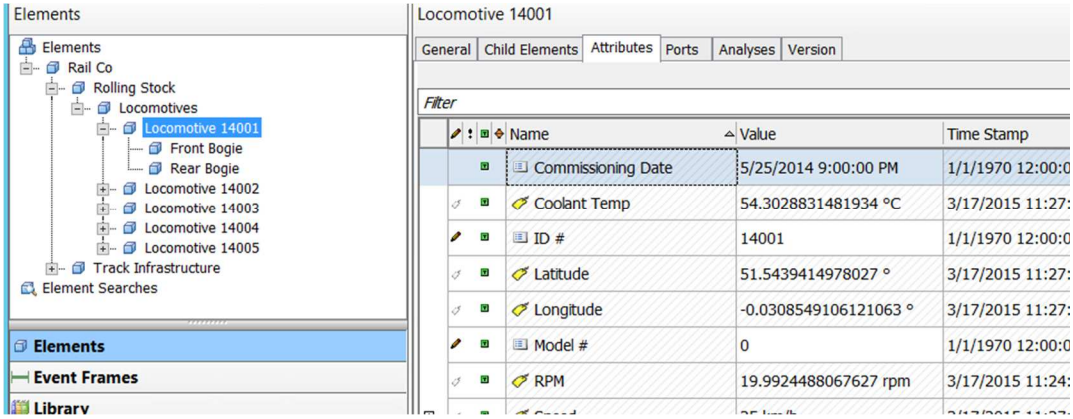


Notice (spoiler alert) that the Element Templates contain Attributes that are of type "Double", for **Longitude** and **Latitude**. These will allow instances of this Template to be positioned correctly on a map. Notice that besides that, there is nothing at all special about these Elements—that's right; any PI AF Element Template can be used, so long as it supplies location information[1]. What kind of data from your site or organization would benefit from being visualized on a map?



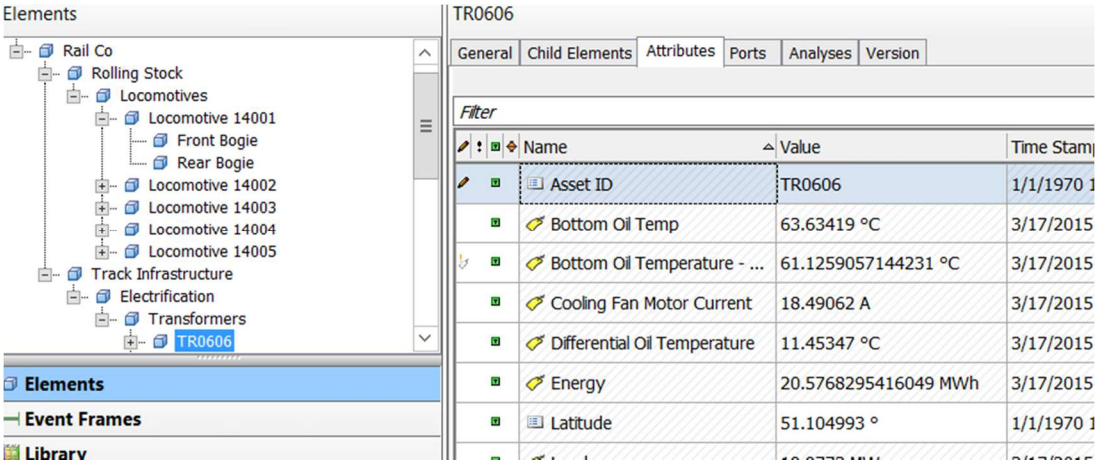
[1] And technically, the PI AF Element template doesn't need to provide location information at all. In an advanced use case, PI data can be streamed to preexisting Esri Feature Services that are already located on a map, in which case the Element template doesn't need to supply any geometry at all.

5. Now use the navigator pane to click **Elements**, and browse down to the **Rail Co** > **Locomotives** > **Locomotive 14001** Element. Examine it's Attributes under the **Attributes** tab, and verify that the **Latitude** and **Longitude** Attributes are updating every few seconds (you can click the **Refresh** button on the top toolbar; the other Attributes won't update as frequently, but they will update).



It's worth noting again that you technically don't have to use just latitude and longitude geometry; you can instead, for example, create a brand-new Feature Service that has complicated geometry, such as for a meandering pipeline, by specifying that geometry in an AF attribute. You could even use the Integrator to append data to a preexisting Feature Service. That Feature Service, then, could actually have really complicated geometry, such as a complicated cross-country pipeline (an example of this is available in the following YouTube video, from the OSIsoft Learning Channel: https://www.youtube.com/watch?v=fmaS03QylnE). In short, in this scenario, we're using latitudes and longitudes, but you technically don't have to.

6. That was an example of a moving asset; next, look at a static asset. Browse down to the **Rail Co** > **Track Infrastructure** > **Electrification** > **Transformers** > **TR0606** Element. Examine it's Attributes under the **Attributes** tab, and verify that the **Latitude** and **Longitude** Attributes are now static Attributes (you can click the **Refresh** button on the top toolbar to see the other Attributes update instead).



3. Create a Service and Layer via the PI Integrator for Esri ArcGIS

The software has been installed, the configuration steps are done, and our PI AF Database is ready for us to use as a data source to create live Esri Feature Services. Next, we'll proceed through the steps to use all that we have created and prepared: actually using the PI Integrator for Esri ArcGIS to create Esri Feature Services that update in real-time with PI System data. Later on, we'll create a map-based dashboard using those Feature Services. For now, let's get started in the PI Integrator for Esri ArcGIS Application Server—that's where all of this work is done.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

First, let's create a Service to hold both of the Layers that we will create (note: this "Service", which we will create in the Integrator Application Server, is difference from an Esri "Feature Service", which is what we'll later add to a map). When configuring a Service, you can select whether the Service supports a StreamServer and a DisplayServer. The StreamServer allows you to stream data from your PI System to the ArcGIS platform, while the DisplayServer provides PI Coresight display capabilities for map Features. In our case, we'll enable both functions.

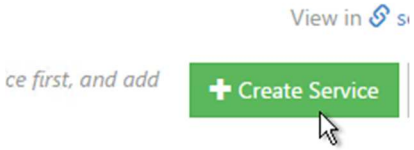
1. Access the link to the PI Integrator for Esri ArcGIS home screen (for example, https://pi1.nugreen.org:6443/pigeoportal) and log in.

   Since this is the first time you have started the PI Integrator for Esri ArcGIS, the following message displays:

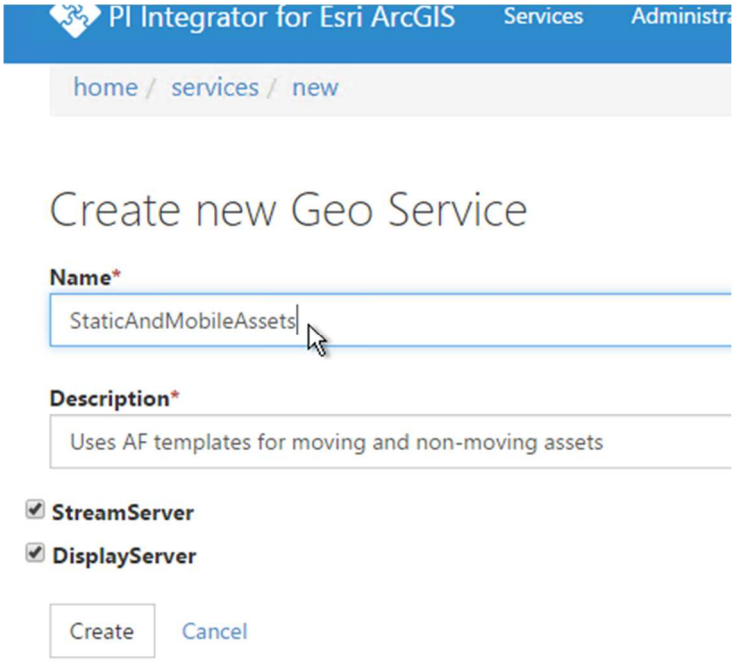
   ```
   You don't have any Services defined. Click here to add one.
   ```

   Later, after you have logged in and created Services previously, a list of Services is displayed. You can change how the list of Services is displayed by clicking either Table view or Tile view; the Tile view displays Services in a series of boxes or "tiles," while Table view shows the Services in a table.

2. Click the **Create Service** button to add a new Service.



The **Create new Geo Service** page opens.

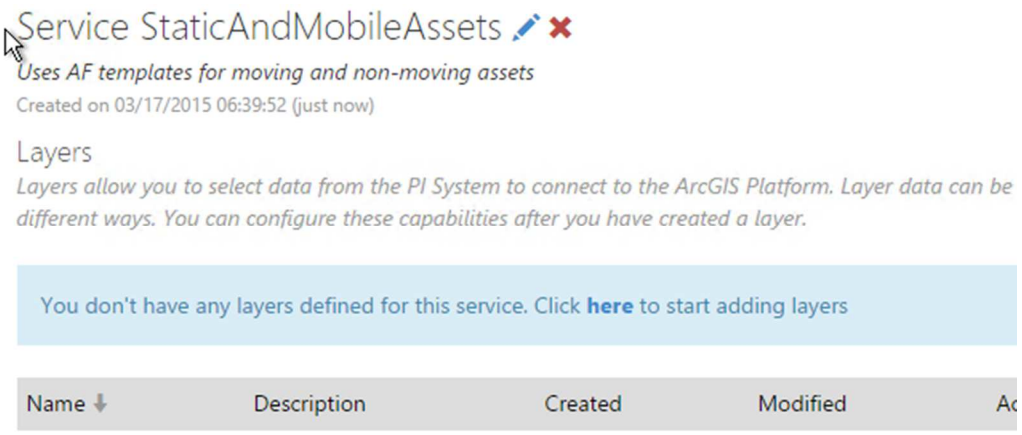


3. In the **Name** Field, enter a name for the new Service (which is required; the name must also be unique); you can call it **StaticAndMobileAssets**. The name should contain a minimum of five lowercase or uppercase alphanumeric characters, hyphens, or underscores (do not use special characters in the name).
4. In the **Description** Field, enter a description for the Service.
5. Make sure that both the **StreamServer** and **DisplayServer** check boxes are checked (this is true by default), then click **Create**. The Service is now created, and the details page of the Service you just created are displayed. From this page you can create one or more Layers, and you can configure the StreamServer and the DisplayServer, which are covered in later topics.

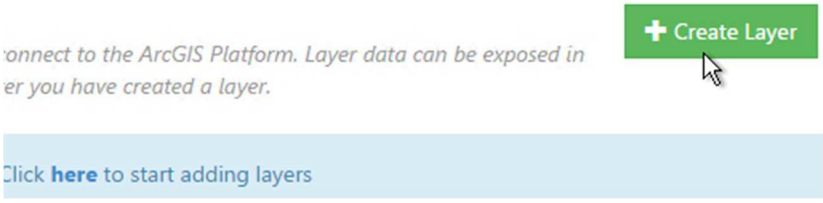
Having finished this step, we will create Layers within this Service, with each Layer being based on a PI AF Element Template. Eventually, we will create two Layers: one Layer for the Element Template for moving assets (a.k.a. the Locomotives Element Template) and one for the Element Template for static assets (a.k.a. the Transformers Element Template).

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

1. Examine the Service details page (you can also access this by clicking on the Service from the PI Integrator for Esri ArcGIS home screen); since we have not previously defined a Layer, the following message displays:


Service StaticAndMobileAssets
Uses AF templates for moving and non-moving assets
Created on 03/17/2015 06:39:52 (just now)
Layers
Layers allow you to select data from the PI System to connect to the ArcGIS Platform. Layer data can be different ways. You can configure these capabilities after you have created a layer.
You don't have any layers defined for this service. Click here to start adding layers
Name
Description
Created
Modified

   Later, once we have defined one or more Layers, they will be listed alphabetically on the screen.
2. Click either the **here** link or the **Create Layer** button.

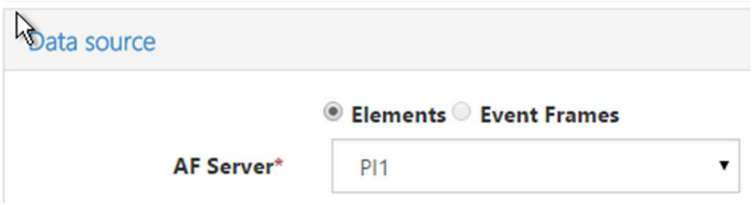


3. In the **Name** Field, enter a name for the new Layer. The name is required and must be unique. In addition, the name must contain a minimum of five characters, may contain only lowercase and uppercase alphanumeric characters, hyphens, and underscores, and cannot include spaces or special characters. In this case, set the name of the Layer to be the name of one of the PI AF Element Templates that we examined earlier (first you will create a Layer for the Locomotives Template, and then when you're all done, including after finishing the ArcGIS Wizard (done in a later section), you'll repeat the whole process for the Transformers Element Template).
4. Enter a description for the Layer in the **Description** Field.

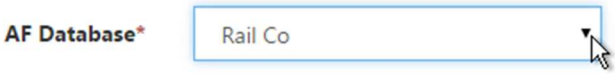
5. Click the **Continue** button. Next, we will configure this Layer.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

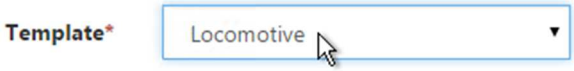
6. In the AF Server drop-down list, select the AF server that you wish to use. The drop-down displays all of the AF Servers that are known to the PI Integrator for Esri ArcGIS Data Relay. When you select an AF server, all of the databases defined on that server are shown in the AF Database drop-down list (the servers must be defined in the servers list in PI System Explorer).



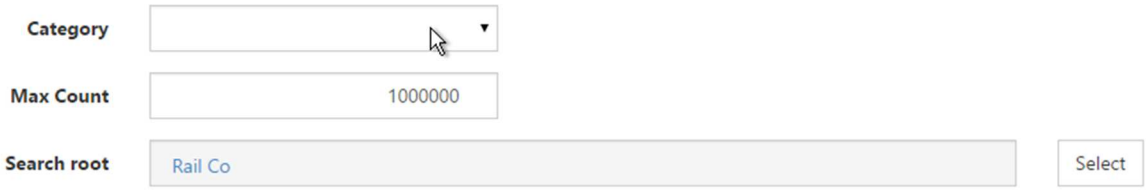
7. In the AF Database drop-down list, select the AF database that you wish to use (in our case, there is only one, the one formerly known as **Rail Co**). When you select an AF database, all of the Templates defined in that database are shown in the Template drop-down list.



8. In the Template drop-down list, select the Template you wish to use; it should either be the mobile assets Template (Locomotives) or the static assets Template (Transformers).



The **Category**, **Max Count**, and **Search root** fields are optional; we won't use them this time.

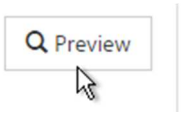


a. You could, though, in the **Category** drop-down list, select the AF Element category that you wish to use. You use a category to classify AF Elements in the Layer; we didn't use these in our case, but they can be helpful.
b. In the **Max Count** Field, you could also specify the maximum number of objects returned from a search. Because some searches might return thousands or even tens of thousands of results, the max count prevents bogging down the system by preventing large numbers of AF Elements being returned when performing a search.
c. In the Search root Field, you could specify the starting node from which to search.

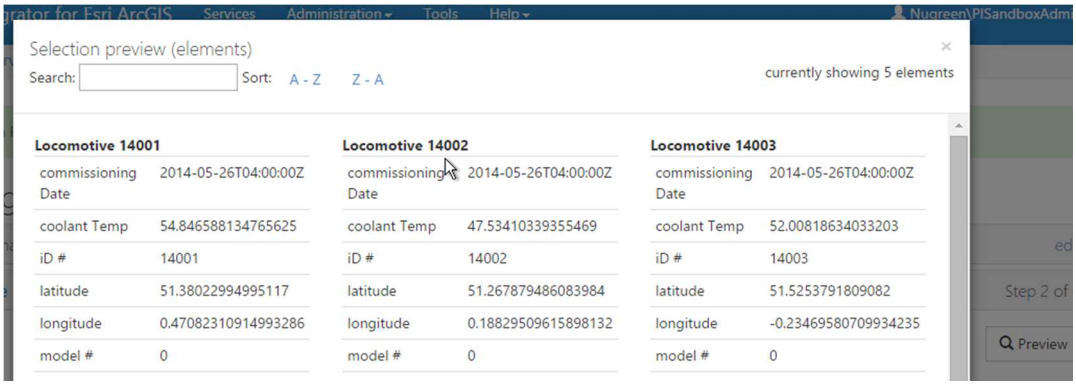
   The **Search root** Field specifies where in the path the search should start; you can drill down as far as you wish into the search path. A "node" is an Element in a hierarchy in an AF database which forms the root of a search, and all Elements below this node which are derived from the selected Template will be found.

   You can specify the search root node by clicking the **Select** button located next to the **Search root** Field. You can traverse the database tree to locate and specify the starting node from which to search.

9. There is also a **Preview** button that you can click to see the results of your Layer search.



Using the Preview is an important step that you should always do, as it helps you verify that your Layer is indeed referencing data from the intended PI AF Elements. Click **Preview** and make sure that the PI AF data that you expect is returned by your Layer.

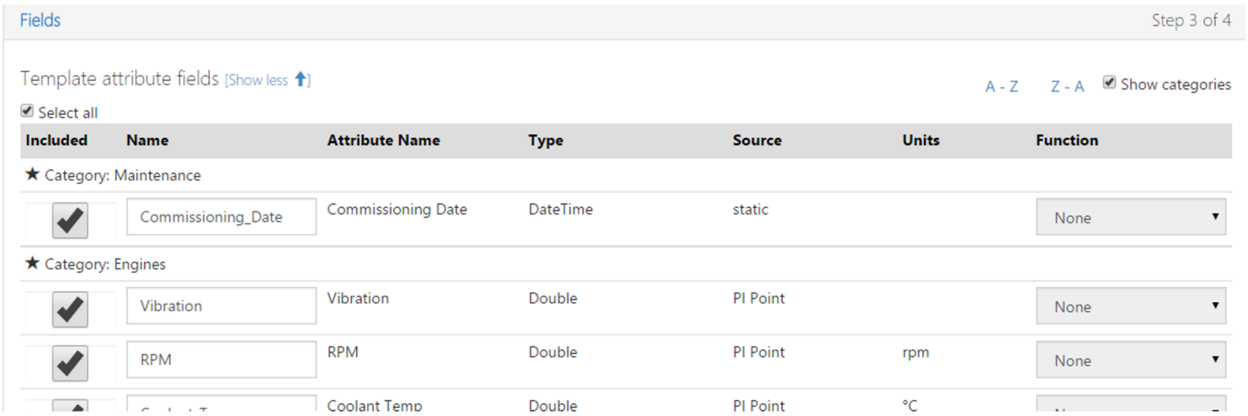


10. Click the **Continue** button.

Next, we will configure all of the Fields for this Layer.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

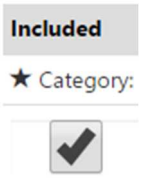
You configure Fields for a Layer to determine which AF Attributes will be published as Fields in your Layer. To begin, the **Template Attribute Fields** section of the Layer definition screen shows all of the Attributes found using the AF Template. By default, those Attributes are listed by Attribute category; you can uncheck the **Show categories** check box to list Attributes alphabetically.



Note: you must always specify one of the Fields as a **key** Field. The **key** is a unique identifier Field for a map Feature that allows data from a specific AF Element to be sent to the correct Esri map Feature; for example, this can be the AF Element name. In our case, this is what we will do.

Use the following steps to configure the Fields in the Layer definition. The **Field configuration view** shows the following columns for each Field:

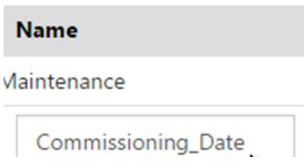
Included



All Fields are included by default, and we'll leave it this way (however, you could improve performance by deselecting unwanted Fields or Fields that will not be used; transferring Field data that is not used can slow system performance, and in addition, having fewer Fields might make the list easier to understand).

You can select the individual Fields that you want exposed in the **Template Attribute Fields** section. Fields with a checkmark are used in the Layer, while those without a checkmark are not. Again, we'll leave all Fields selected for these examples.

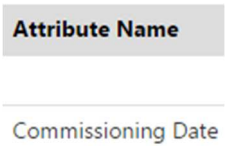
Name



The name Field shows the final name that will be used in the ArcGIS platform. The name can be customized to be different from the Attribute name specified in PI AF, if necessary, to make it easier for users to understand—we won't make any changes here.

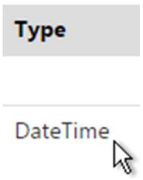
Attribute names must be composed from simple alphanumeric characters: A-Z, a-z, and 0-9 and underscore (_). When the **New Layer** page opens, the AF Attribute names are converted automatically to simple alphanumeric characters (for example, characters with diacritical marks are converted into the closest corresponding simple characters), but they may then be edited further as desired. Validation cues will appear if the user modifies an Attribute name to contain invalid characters.

Attribute Name



The original name of the Attribute as it appears in PI AF. The Attribute name cannot be changed in this screen.

Type



The data type of the Attribute, pulled from PI AF.

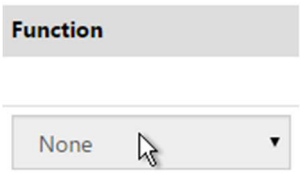
Source

The name of the AF data reference or static. The Attribute source can be PI point, calculation, or static.

Units

The default measurement unit for the Attribute.

Function



The **X** and **Y** functions are pre-selected if the application finds any Attribute name that contains the words **longitude** or **latitude**, or **X** or **Y**; if so, the application assigns them to the **X** and **Y** function (if desired, you can select a different function: **None**, **X**, **Y**, **Key** or **Geometry**). Generally, you specify **X** and **Y** functions for Attributes that indicate geographic positions, including positions that move over time. Only one **X** and **Y** pair can be specified. In our case, we will accept the default **X** and **Y assignments**.

For the **Function** drop-down, there are several options:

Specifying X and Y

By specifying the **X** and **Y** functions, you determine which Field values define the location of the map Feature that corresponds to your AF Element. For example, when you have **longitude** and **latitude** values defined in your AF Element Template, you can select the **X** function for the **longitude** Attribute and the **Y** function for the **latitude** Attribute. **X** and **Y** must be defined in pairs; you cannot have an **X** value without a **Y**, value and you cannot have a **Y** value without an **X** value. Furthermore, **X** and **Y** function Fields must always be of type **numeric**.

Again, in our case, we will accept the default X and Y assignments, since our PI AF Template includes Attributes named Latitude and Longitude.

Specifying a geometry

Another option (which we won't use here), rather than specifying **X** and **Y**, is to specify the geometry for a map Feature by defining it in Esri Feature Geometry Json. See Esri geometry information (http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=The_geometry_object) for more information. Specifying a geometry allows for much more complex areas to be defined, such as polylines or polygons. Geometry function Fields must be of type string.

Specifying a key function

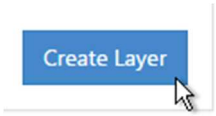
In our case, under **Element fields**, set the element **name** Field to have the **key** function. The **key** function specifies a unique identifier for a particular map Feature; the **key** function is used when updating specific map Features in a Feature Service with the right data from the corresponding AF Elements, and also when generating PI Coresight displays. In your own environments, use care to ensure that the values of the Field that receives the **key** function are unique for your configured search parameters.

Press **Continue** when finished configuring Fields. A message is displayed if an error is found with the configuration (fix the error (feel free to ask for help) and try creating the Layer again).

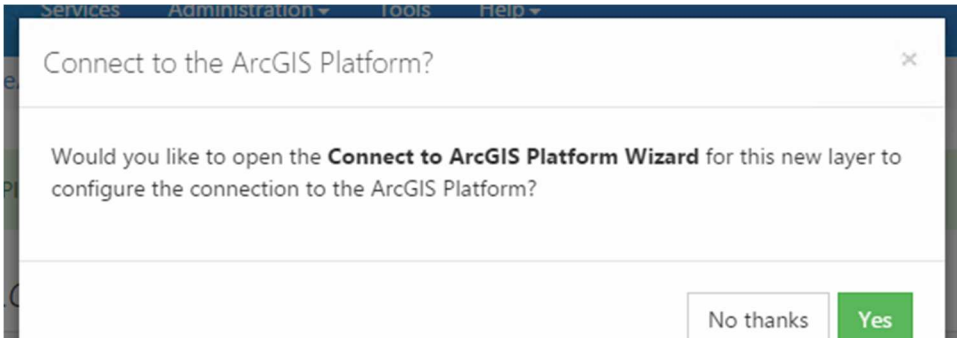
You'll next see the option to specify the **Geometry Type**.

This allows you to specify a different **Geometry Type**, if you're using Features that aren't points, such as polylines; we are only using points in our case, so we'll use the defaults that appear. You can also specify the **Spatial reference**, if you know that your latitude and longitude values were obtained using a particular spatial reference model for the world. In most cases, though, the default reference, **GCS_WGS_1984 (4326)** should suffice, so in summary, leave all of these settings as is.

Go ahead and click **Create Layer**.



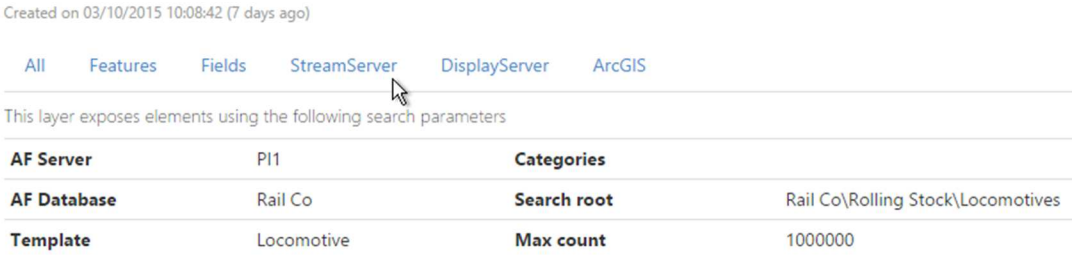
You'll see a prompt to proceed to launch the **Connect to ArcGIS Platform Wizard**. We actually will pause before doing this now, so you should go ahead and click **No.**


Services
Administration
Tools
Help
Connect to the ArcGIS Platform?
Would you like to open the Connect to ArcGIS Platform Wizard for this new layer to configure the connection to the ArcGIS Platform?
No thanks
Yes

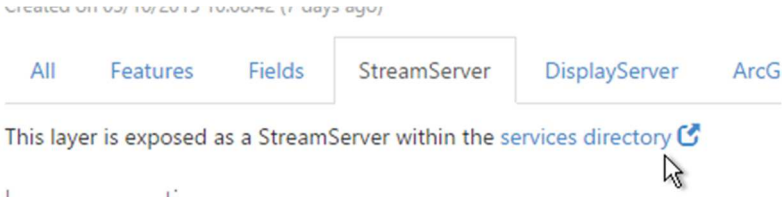
Rather than proceed immediately, at least for this exercise, it's worth mentioning an important troubleshooting step. We will click **No thanks**, and then navigate to the Layer details page. There you will explore the ability to launch a powerful tool that allows you to see what data is actually being streamed; this could help you verify that your Layer is configured properly.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

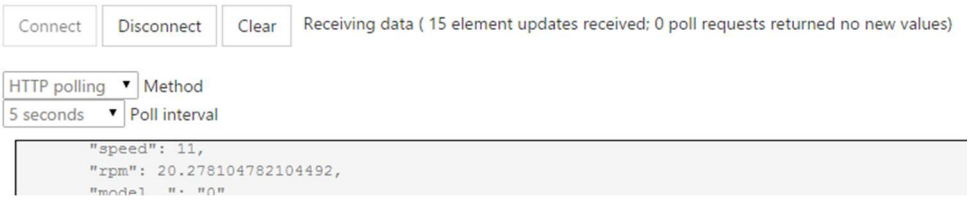
From the details page for the Layer, click the **StreamServer** tab.



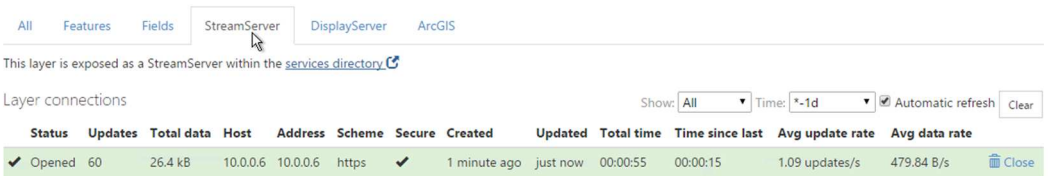
Then click "**This Layer is exposed as a StreamServer within the Services directory**." The resulting page lets you manually stream updates from the Layer, so you can see what data is being sent.



Click **Connect** to manually open a connection, to see that data is being sent by the Integrator to the Esri platform, and specifically, you can see how the sent data includes live PI data values, which include the x and y values needed to place a Feature on a map. When done, click **Disconnect.**



Back on the details page, under the **StreamServer** section, the StreamServer state is displayed, using a table with the following columns:


All
Features
Fields
StreamServer
DisplayServer
ArcGIS
This layer is exposed as a StreamServer within the services directory
Layer connections
Show: All
Time: *-1d
Automatic refresh
Clear
Status Updates Total data Host Address Scheme Secure Created Updated Total time Time since last Avg update rate Avg data rate
Opened 60 26.4 kB 10.0.0.6 10.0.0.6 https 1 minute ago just now 00:00:55 00:00:15 1.09 updates/s 479.84 B/s
Close

Status

Whether the connection is opened or closed.

Updates

The number of transmitted Feature updates. An update is defined as one payload of values.

Total data

The total file size of these Feature updates.

Host

The IP address of the Application Server.

Address

The IP of the recipient (typically, the GeoEvent Extension).

Secure

Shows whether you will be using an HTTPS connection or not.

Created

The amount of time that has passed since the connection was opened.

Updated

The amount of time that has passed since the last Feature update was transmitted.

Total time

The difference between the time of the last update and the time of creation.

Time since last

For open connections, the difference between the current time and the time of the last update.

Average update rate

The update count divided by the total time.

Average update data rate

The total data divided by the total time.

Now that you are done exploring these important troubleshooting steps, proceed to section 4 by first, from the Layer details page, clicking on the **ArcGIS** tab, then the link to launch the ArcGIS Wizard.

4. Run the ArcGIS Platform Wizard

In section 3, when you finish defining a Layer and click **Create Layer**, the Layer is created and a window opens asking whether to connect the Layer to the ArcGIS platform, specifically, via the ArcGIS Wizard, which makes it very easy to automatically configure the Esri GeoEvent Extension to take PI AF Element data from your newly created Layer and use that data to update the specific Features in your Esri Feature Service. We will now launch that Wizard. We have already taken care of the prerequisites for the Wizard:

> We have given each of you an ArcGIS Online account that has privileges to publish a hosted Feature Service.
>
> Your ArcGIS Online account is registered as a data store in ArcGIS GeoEvent Extension.
>
> The ArcGIS GeoEvent Extension is indeed running and is configured as a known ArcGIS GeoEvent Extension in PI Integrator for Esri ArcGIS.
>
> We've entered into the Application Server administrator credentials for your ArcGIS GeoEvent Extension.
>
> The GeoEvent Extension Manager certificate is set to be a trusted and valid certificate.

The wizard will walk you through four steps:

1. Specify the Feature Service environment
1. Create the Feature Service
2. Configure the GeoEvent Extension
3. Configure advanced settings

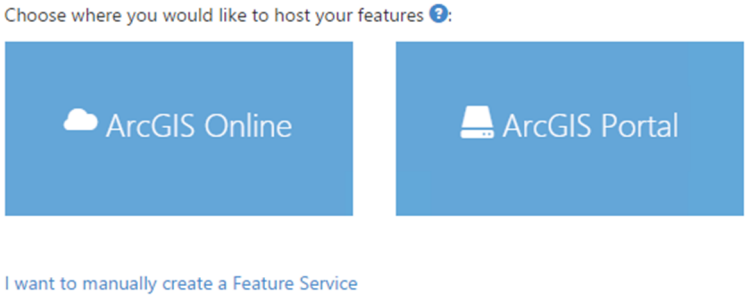
We will wait until everyone is done creating their first Layer, and then we will proceed so that everyone can run through these four steps together. Again, after section 3, you should have clicked on the ArcGIS tab, in the details page, and then clicked the link to launch the Wizard to configure the layer's connection to the ArcGIS GeoEvent Processor.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

1. Specify the Feature Service environment

The GeoEvent Extension retrieves data from the PI Integrator for Esri ArcGIS and outputs the data to a Feature Service. The Feature Service can be hosted either in ArcGIS Online or on an ArcGIS Application Server.

You are presented with the choices for creating the Esri Feature Service:


Choose where you would like to host your features:
ArcGIS Online
ArcGIS Portal
I want to manually create a Feature Service

ArcGIS Online (to select the ArcGIS online cloud server; we'll use this option, as we've already registered our ArcGIS Online account as a Data Store on the GeoEvent Extension)

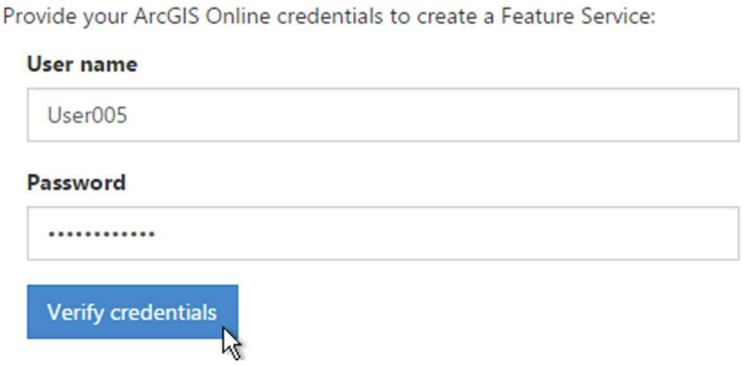
ArcGIS Portal (to select a local ArcGIS server; we won't use this option)

I want to manually create a Feature Service (to download a csv file and use it to publish manually; we won't use this option)

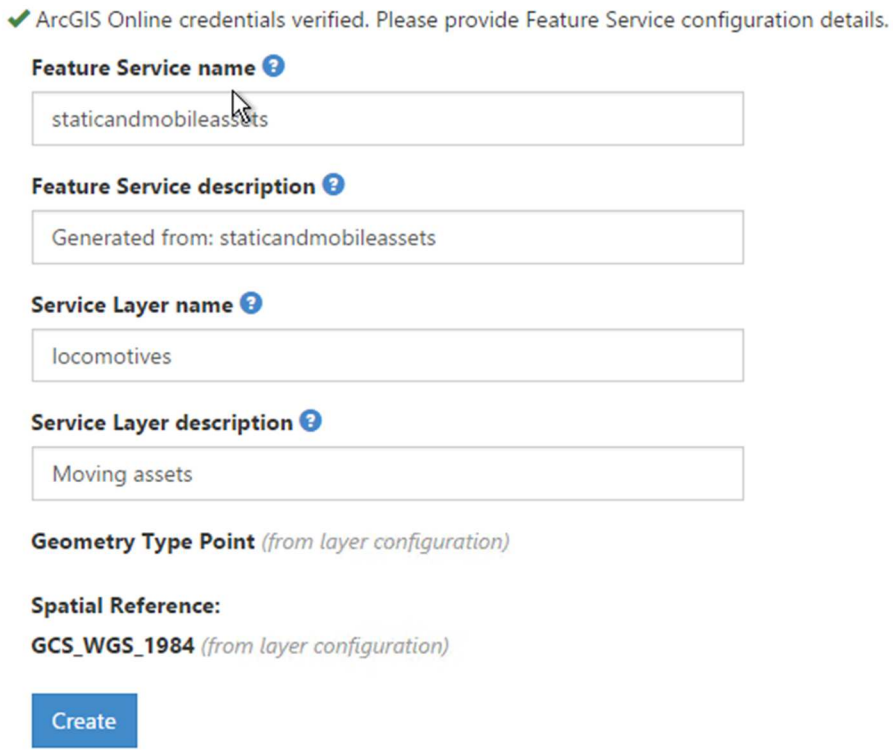
2: Create the Feature Service

You will use the ArcGIS online option to automatically create an ArcGIS Feature Service with the appropriate schema for your Layer.

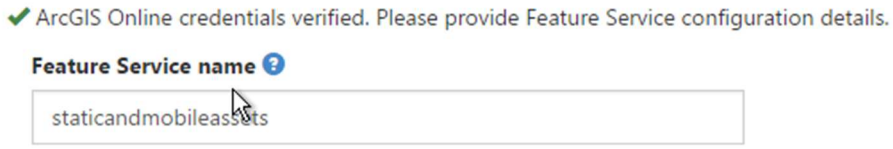
1. On the **Create Feature Service** screen, enter your ArcGIS Online User name and password. The account credentials you use must have administrator privileges within the specified organization; we've already set those permissions for you.



2. Click **Verify credentials**. Once your ArcGIS Online credentials are validated, the wizard shows a suggested Service and Layer name, with description Fields.



3. **Important:** append your ArcGIS Online username (which you entered earlier in step 1) to the front of the **Feature Service name**. For example, in this case, rather than use the default name, **staticandmobileassets**:

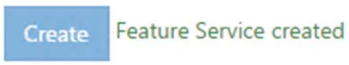

ArcGIS Online credentials verified. Please provide Feature Service configuration details.
Feature Service name
staticandmobileassets

You should *instead* use a new name with your own ArcGIS Online username appended to the front, such as **User005staticandmobileassets**.

ArcGIS Online credentials verified. Please provide Feature Service configuration details.
Feature Service name
User005staticandmobileassets

This naming is *essential*, because since we're all sharing the same ArcGIS Online organization, we need to make sure that each person's Feature Services are unique.

4. Leave the default Service description (you could, if you want, enter a new description).
5. Leave the default Layer name and description (you could, if you want, enter a new name and description).
6. Click **Create**. When you select **Create**, the Service and Layer are created in ArcGIS Online. If successful, the "Feature Service Created" message is displayed.



Note: you could then, in a separate browser window, log in to ArcGIS Online to view and change permissions on your new Feature Service, so that others in your organization could use that Feature Service in their own Web Maps and dashboards. In our case, we won't do this, just for simplicity's sake. Should you wish to experiment with sharing, though, it's important to note that you should be cautious about choosing the option to share your Feature Service with **Everyone**, as that will allow the ArcGIS Online global community to subscribing to your Feature Service, and thus to have access to your live PI System data.

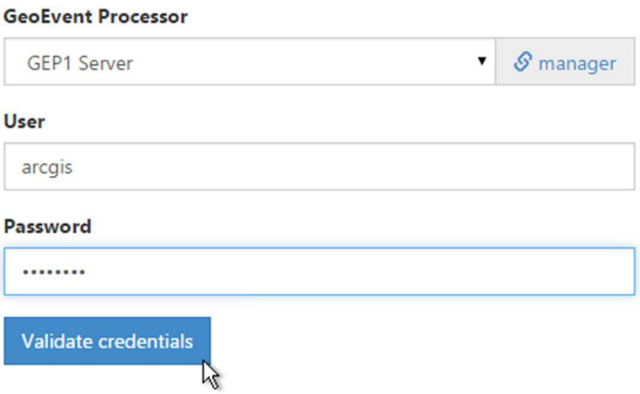
7. Having created your Feature Service, click **Next** to display the Configure GeoEvent Extension screen; that will allow you to configure the GeoEvent Extension to accept the streamed data from the PI Integrator and output it to the Feature Service that you just created.

3. Configure the GeoEvent Extension

After creating the Feature Service, you can connect the Service to the GeoEvent Extension. The Feature Service that was created previously should be selected automatically for you.

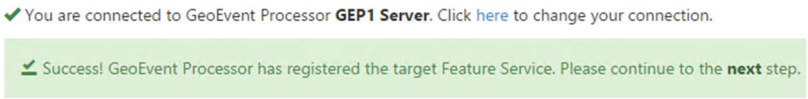
1. In the **GeoEvent Extension** Field, select the appropriate GeoEvent Extension from the list of all registered GeoEvent Extensions—remember, we verified earlier that yours was properly registered (if you wanted to, to check up on that GeoEvent Extension, you can click the **Manager** button to open a new browser tab containing the ArcGIS GeoEvent Extension Manager).

2. Enter the User ID and password for the GeoEvent Extension (these are supplied by your instructor; see page 8) and click **Validate credentials**.



These credentials are not Windows credentials, nor are they ArcGIS Online credentials; these are completely separate. After you credentials are verified, the wizard connects to the GeoEvent Extension and retrieves information about all configured ArcGIS servers (also known as data stores, such as the one we examined earlier that had been created for your ArcGIS Online account.

3. Since you used the Wizard to create your Feature Service, then after clicking **Validate credentials**, the Wizard begins polling the GeoEvent Extension to detect the newly created Feature Service in one of the GeoEvent Extension's data stores (which you verified earlier), which can take a few minutes. You will be notified when the process is complete, after which you may proceed to the next step.


You are connected to GeoEvent Processor GEP1 Server. Click here to change your connection.
Success! GeoEvent Processor has registered the target Feature Service. Please continue to the next step.

(It's worth noting that you could have created your Feature Service manually, instead of using the Wizard, in which case there are a few other steps to follow, but those don't apply to us here.)

4. Click **Next**.

4. Configure advanced settings

While default values are provided, you can modify several settings on the Advanced Settings screen.

As a brief recap, recall that the GeoEvent Extension works by taking an input from PI Integrator for Esri ArcGIS, and connecting it with a Feature Service output. How the input and output are related is determined by a geoevent Service, which, at the simplest level, simply connects an input to an output. This procedure allows you to automatically configure the input, output, and geoevent Service on the GeoEvent Extension.

1. In the **Input**, **Output**, and **Service** Fields, verify that the appropriate input, output, and Service values are displayed. If not, change as appropriate (the defaults should be fine, though). You should take care to remember these names for step 8.

Note:

Default names are provided for the input, output, and Service name Fields. You can change the names as desired; however, the names should contain only letters, numbers, hyphens and underscores. Avoid using spaces and special characters such as &, ^, or %.

The minimum length for each Field is five characters, and the maximum length is 200 characters. All three Fields are required to have valid names before continuing. A message is displayed when an input is incorrect.

2. In the **Identity (key)** Field, verify that the default identity Field setting is appropriate. By default, the Attribute that was selected as the key is entered into the Identity (key) Field, but you have the option of using a different Field if desired (leave this as is).

3. In the **Refresh Interval** Field, specify (in seconds) how often the GeoEvent Extension should poll the Integrator Application Server for new data. The default refresh interval is 5 seconds (leave this as is).

4. In the **Session Inactivity Timeout** box, specify the amount of time that must elapse before the connection between the GeoEvent Extension and the Integrator Application Server is considered closed. The activity timeout helps manage resources on the Data Relay; when the GeoEvent Extension begins polling again, data flow resumes seamlessly. The inactivity timeout should

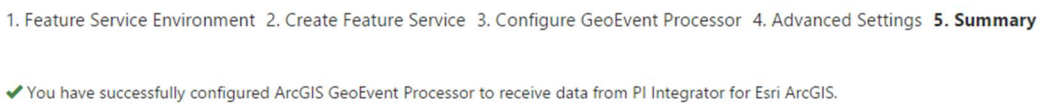
generally be several times greater than the poll interval. The default session inactivity timeout period is 300 seconds (5 minutes).

5. You have the option to check **Use HTTPS (secure)** to specify that all data should be transmitted securely. Using HTTPS requires performing a one-time security configuration on the GeoEvent Extension before data can flow back and forth; in our case, since this is a self-contained environment, do not select this check-box.

If you're interested, though, for information about how to install certificates on the GeoEvent Extension computer to use HTTPS polling, see the following Esri help page: Connecting to sites with certificates issued by unknown certificate authorities via HTTPS (http://resources.arcgis.com/en/help/install-guides/arcgis-geoevent-processor-windows/10.2/index.html#/Optional_Connecting_to_sites_with_certificates_issued_by_unknown_certificate_authorities_via_HTTPS/02wn0000000z000000/)

6. **Click Create Service.** If the Service was created without errors, the following message is displayed: **Service Created – Done!**

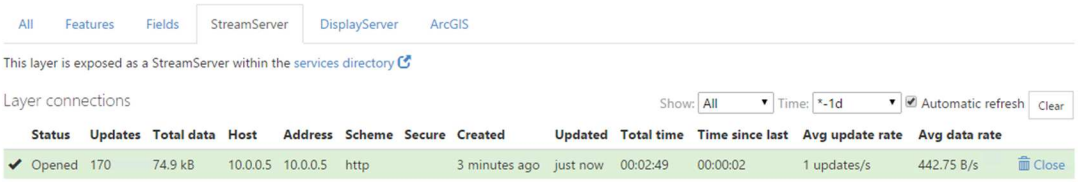
7. Click **Next**. The following message is displayed: **You have successfully configured ArcGIS GeoEvent Processor to receive data from PI Integrator for Esri ArcGIS.**


1. Feature Service Environment 2. Create Feature Service 3. Configure GeoEvent Processor 4. Advanced Settings 5. Summary
You have successfully configured ArcGIS GeoEvent Processor to receive data from PI Integrator for Esri ArcGIS.

8. Click **Finish**. After clicking the Finish button, the Service has indeed be successfully created within GeoEvent Extension, and then you return to the Layer details page.

You should next ensure the following:

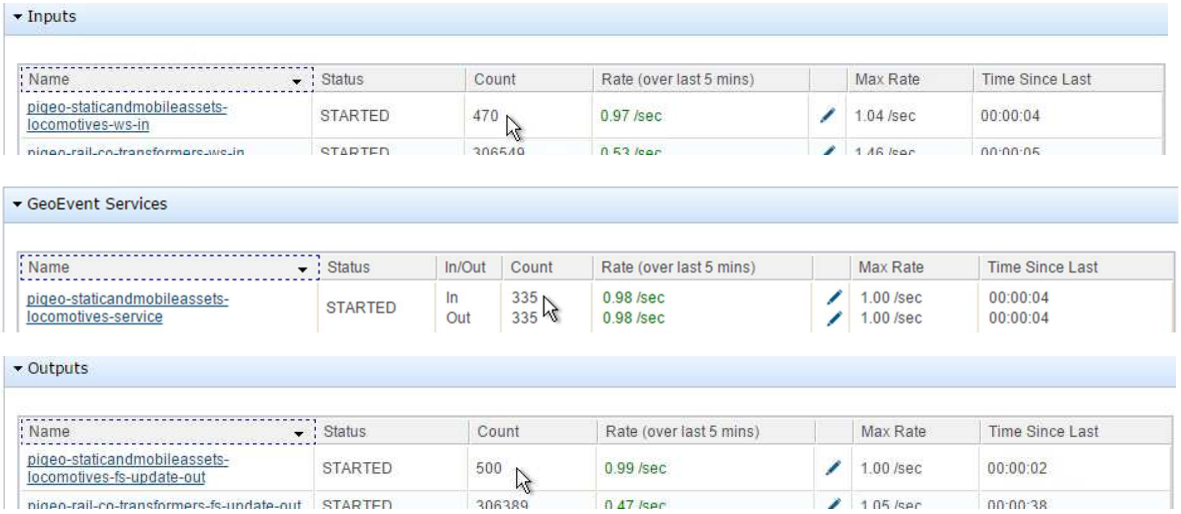
a. Click on the **StreamServer** tab, and verify that an opened connection from your ArcGIS GeoEvent Extension is made to this Stream Server endpoint, which is displayed when the wizard is closed.


All
Features
Fields
StreamServer
DisplayServer
ArcGIS
This layer is exposed as a StreamServer within the services directory
Layer connections
Show: All
Time: *-1d
Automatic refresh
Clear
Status Updates Total data Host Address Scheme Secure Created Updated Total time Time since last Avg update rate Avg data rate
Opened 170 74.9 kB 10.0.0.5 10.0.0.5 http 3 minutes ago just now 00:02:49 00:00:02 1 updates/s 442.75 B/s
Close

b. Your ArcGIS GeoEvent Extension is receiving events from PI Integrator for Esri ArcGIS. Use the ArcGIS GeoEvent Manager to check whether events are received; the URL for the ArcGIS GeoEvent Manager is of the form

```
https:// gep1.nugreen.org:6143/geoevent/manager
```

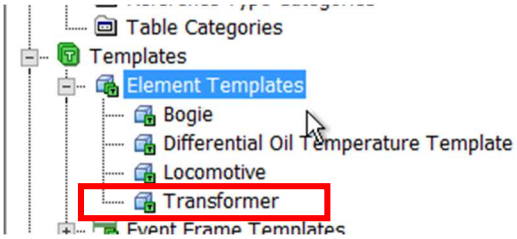
After signing in, you can scroll down to find the Input, GeoEvent Service, and Output; their names are the values you saw in step 1. You should verify that the **Count** of updates for those objects is indeed increasing. If they are, then you can proceed further.

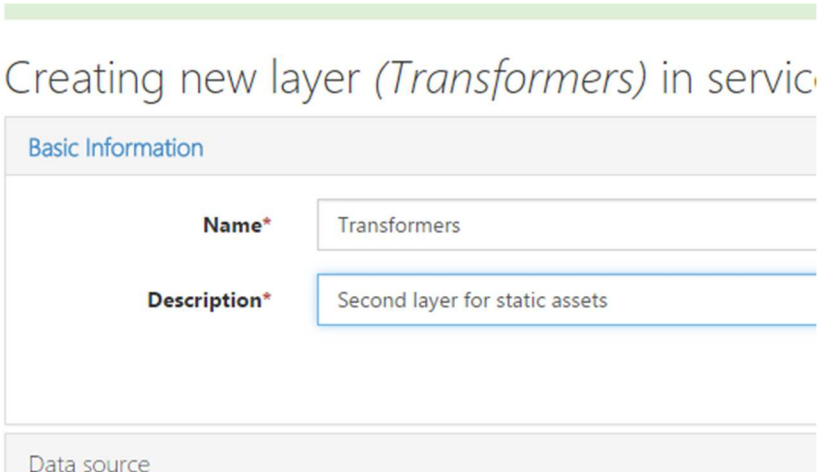

Inputs
Name Status Count Rate (over last 5 mins) Max Rate Time Since Last
pigeo-staticandmobileassets-locomotives-ws-in STARTED 470 0.97 /sec 1.04 /sec 00:00:04
GeoEvent Services
Name Status In/Out Count Rate (over last 5 mins) Max Rate Time Since Last
pigeo-staticandmobileassets-locomotives-service STARTED In 335 0.98 /sec 1.00 /sec 00:00:04
Out 335 0.98 /sec 1.00 /sec 00:00:04
Outputs
Name Status Count Rate (over last 5 mins) Max Rate Time Since Last
pigeo-staticandmobileassets-locomotives-fs-update-out STARTED 500 0.99 /sec 1.00 /sec 00:00:02

Congratulations! It's worth mentioning that what we have done is an incredibly powerful ability of the Integrator. You can actually click on each of these objects that was created, and you can see that a lot of configuration values have been automatically entered in for you by the Integrator. While you could have manually created each object, and then manually configured each in precisely the right way, the Integrator has spared you all of that time, so that you can get back to performing the analysis work that actually brings you value. Of course, for power users, such as yourselves, with a little bit of practice it's certainly possible to configure these objects

manually, and in particular, concerning the **GeoEvent Service**, you can actually get a lot more value out of making manual adjustments. For example, recall how in our case, the **Input** is used to collect data from the Integrator Application Server, and the **Output** is used to write that data to the Esri Feature Service, and the **GeoEvent Service** in our case simply passes data from the **Input** to the **Output**. However, there are so many more powerful functions that you could do with that **GeoEvent Service**, and thus by creating it for you, you get a quick jump-start on performing more advanced geo-spatial analyses (such as geo-fencing, for example).

In any case, having finished this procedure, you should start over again, from section "3. Create a Service and Layer via the PI Integrator for Esri ArcGIS". Specifically, having already created the Service, and having just created a Layer for your first Element Template, Locomotives, you'll simply create a new Layer; you will now create a Layer for your static assets, using the Transformers Element Template.





You'll also run through all the steps in section 4 ("4. Run the ArcGIS Platform Wizard" for this new Layer as well).

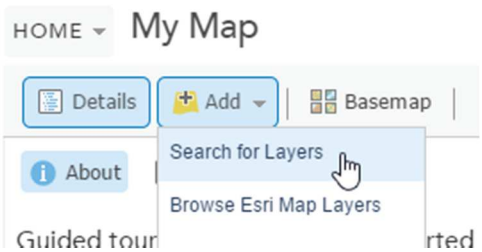
5. Create an ArcGIS Online Web Map to display the new Feature Service

Having created our live-updating Feature Services, we'll visualize them by adding them to an ArcGIS Online Web Map. We'll also format the way data is displayed on the map.

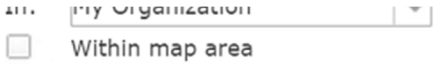
After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

1. Log in to ArcGIS online (your instructor will provide the URL that you should use) with your individual ArcGIS Online credentials (these were used as a data store on the GeoEvent Extension earlier), and click the **Map** menu item:

   A base map is displayed.
2. Add both of more of the Feature Services that you created previously by clicking the **Add** menu item and selecting **Search for Layers**.

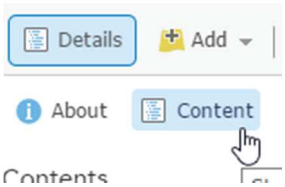
   Make sure that you un-check the box **Within map area**.

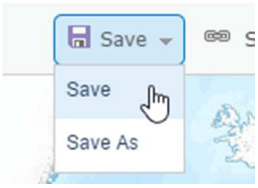
3. In our case, leave the search box blank, and simply hit **ENTER**; the Layers should then be visible. Next to each of your Layers, you'll see the **Add** button.

Click it to add each Layer to your map. When finished, click **Done Adding Layers**.

The Features in your Layers should show up, by default, as green boxes, and when you click on the **Details** button, then on **Content**, you should see two Layers listed. You can then click on each map Feature and see a pop-up appear; the values of that pop-up are set by data streamed directly from the PI System, as is the location of each Feature.



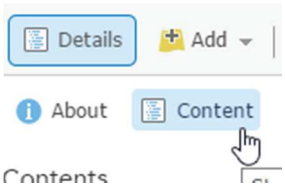
4. Click **Save,** then **Save** again to save your Web Map; enter in a title, tags, and description, then click **Save Map**. Having saved the map, we can thus use it later to create a dashboard in Esri's Operations Dashboard, but for now, we'll work on making the map look a little nicer first.



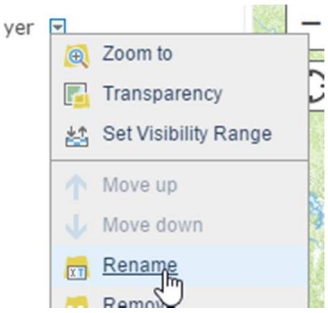
We'll wait for everyone to finish saving their map, making sure that they can see both Layers on their map. After that, we'll configure the symbology of each Layer and make a few other cosmetic changes.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

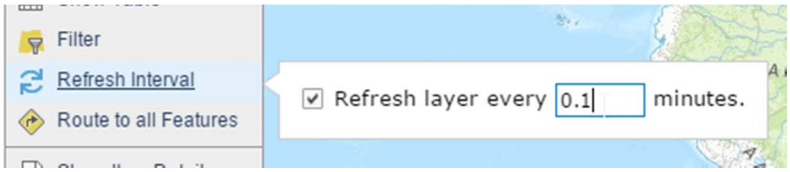
1. Let's give each Layer a more human-friendly name. From the **Details** view, click on **Content**.



Then, mouse-over a layer, and in the drop-down next to a Layer name, and select **Rename**. Give each of your Layers a friendlier name, such as “Locomotives” and “Transformers”. After this, remember to save your map!



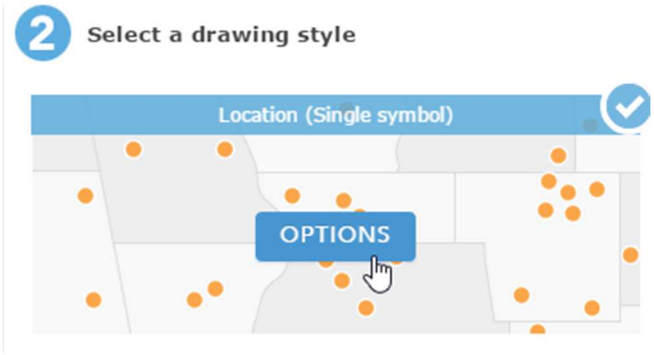
2. Let’s make sure that our Layers are updating on the right schedule. Click on the drop-down next for each Layer name, and select **Refresh Interval**, and type in the refresh interval, in minutes: in your case, we recommend entering in **0.1**, to give a 6-second refresh interval, for both Layers.



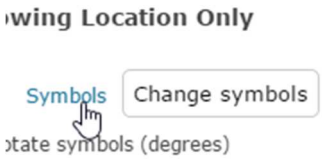
3. Let’s also give each Layer more appropriate symbols. Again, click on the drop-down, and select **Change Style.**

We want to show the location of these Features, so you should leave the first drop-down at **Set Location Only**:

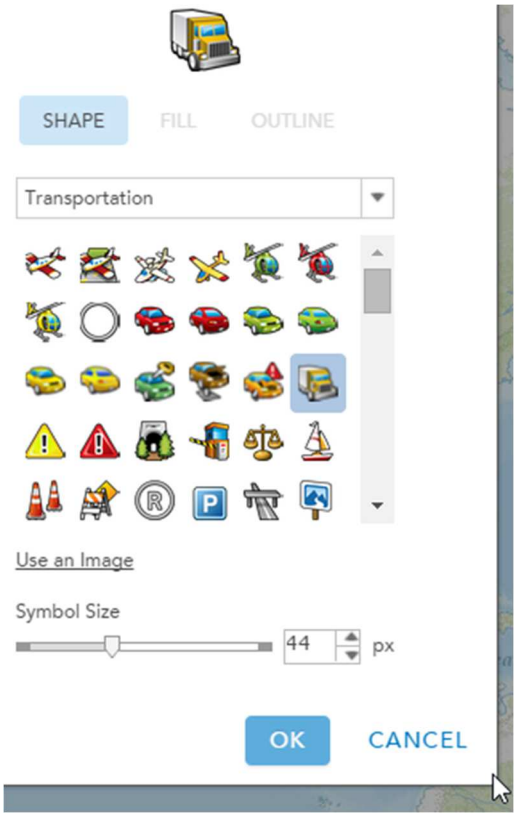
(If you wanted to have the symbols vary based on a particular attribute, you would select one of the Fields listed in the drop-down; see the **Appendix** at the end of the workbook for suggestions). After leaving that at **Show location** only, to configure how the symbols look, you should click **Options.**



You can select a single symbol for your Layer; to configure it, click **Symbols**, and then explore the many different symbol collections offered in the drop-down.

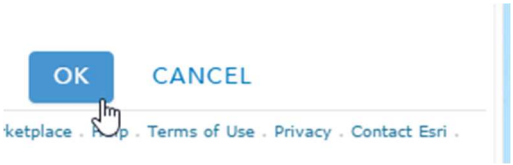


For example, for your mobile assets Layer, select **Transportation**, and select the truck symbol. Set its size to be **44px**, then click **OK**.

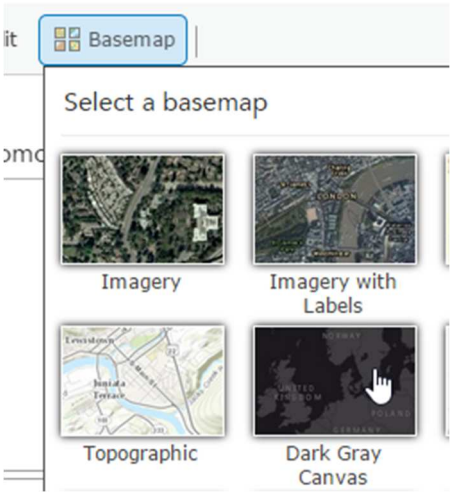


You could of course select any other symbol, specify any other size, or even add your own custom image, if you know the web URL where that image resides. For example: http://www.microsoft.com/global/enterprise/PublishingImages/partners/OSIsoft/osisoft_logo.png

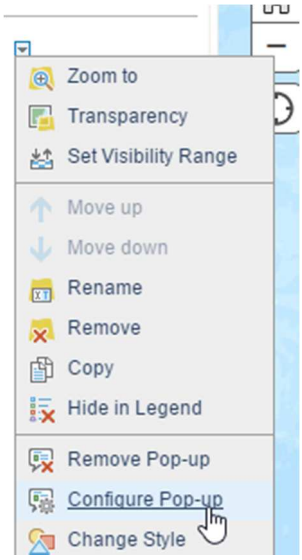
You can also change the transparency of your layer, or set the visible range, to change the zoom level at which your layer will appear. We'll leave these settings alone for now; now that you're done, just click **OK**. Remember to save your map!



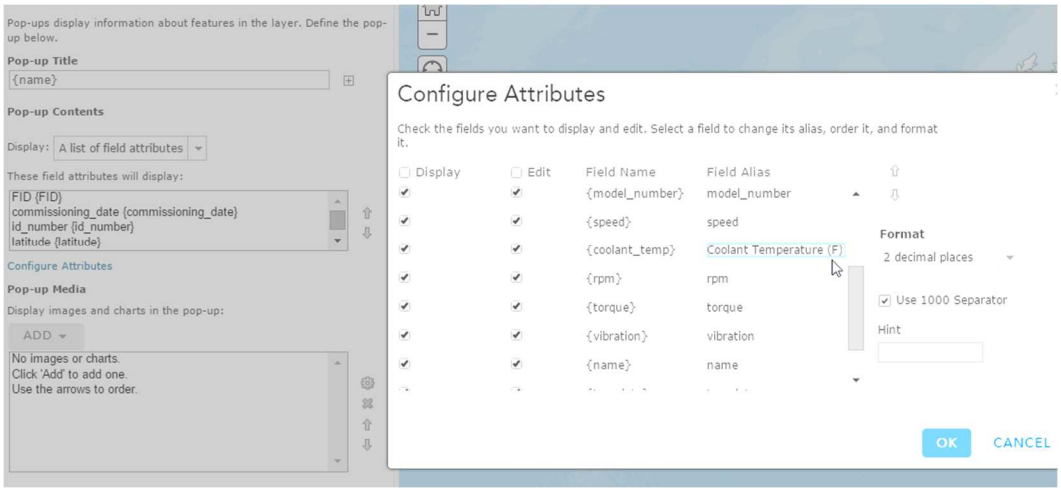
4. Let's also change the basemap to a more exciting map. Click on the **Basemap** button, and select one of the many different basemaps, such as "Imagery", or "Dark Gray Canvas". Again, after this, remember to save your map.



5. Finally, let's make our Feature pop-ups more presentable. If you click on a map Feature, you'll see a pop-up appear, but you'll notice that capitalization may be missing, and that spaces have been replaced with underscores. Let's fix that. For each Layer, click on the drop-down next to the Layer name, then select **Configure Pop-up**.



For the **Pop-up Title** Field, erase the current contents, and click the plus sign to add in a Field value; let's use the **{name}** Field, which means each pop-up will be titled with the Feature name. Next, select the **Configure Attributes** link. Double-click each alias in the **Field Alias** column to edit it, correcting spaces, capitalization, and adding units if you wish.



When done, click **OK**, then **SAVE POP-UP**, then save your map.

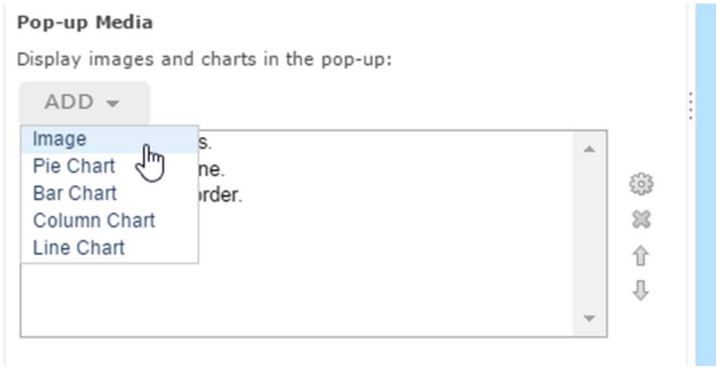
Next we'll add PI Coresight integration, so that in addition to seeing a map with live locations, and with pop-ups that feature live values from the PI System, you can also click a pop-up image to automatically open an ad hoc PI Coresight display.

6. Add PI Coresight integration to the ArcGIS Online Web Map

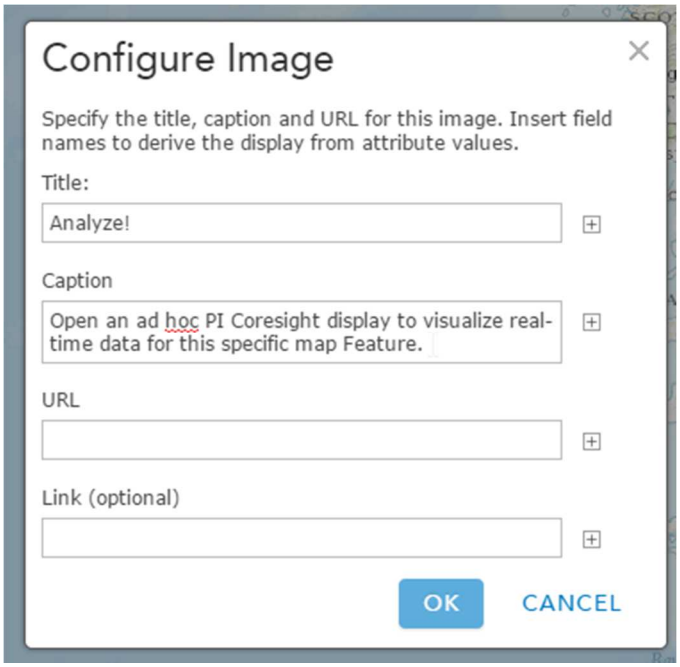
We'll wait for everyone to finish preparing their Layers map; after that, we'll set up PI Coresight integration.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

1. Open your map in ArcGIS, if you're not already there.
2. Select one of the Layers by clicking it; a drop-down list appears next to the selected Layer.
3. Select **Configure Pop-up** from the drop-down list; you'll see the list of pop-up properties that we visited earlier.
4. Select **Image** from the **ADD** drop-down list in the **Pop-up Media** section.

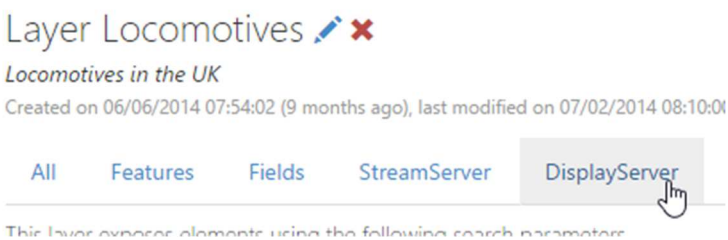


5. In the **Configure Image** window, as a title, you can enter "Analyze!" As a caption, enter "Open an ad hoc PI Coresight display to visualize real-time data for this specific map Feature."

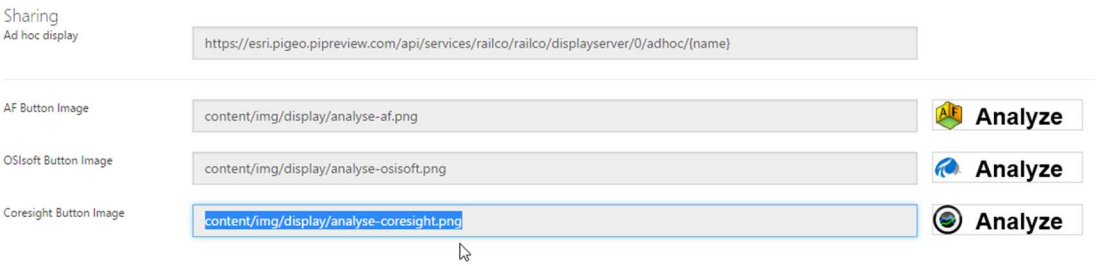

Configure Image
Specify the title, caption and URL for this image. Insert field names to derive the display from attribute values.
Title:
Analyze!
Caption
Open an ad hoc PI Coresight display to visualize real-time data for this specific map Feature.
URL
Link (optional)
OK
CANCEL

For the URL, we'll need to go back to the Integrator Application Server.

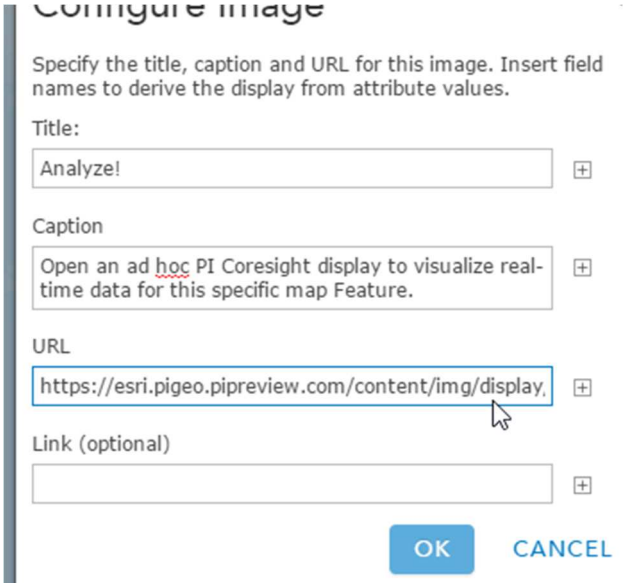
a. In a separate browser tab, open the PI Integrator for Esri ArcGIS Application Server.
b. Navigate to the Service that you created in section 3, and select within it the Layer that corresponds to the Esri map Layer that you're now editing.



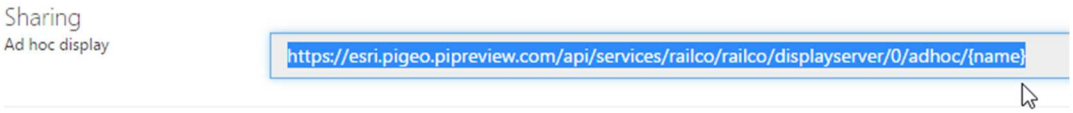
c. Click the **DisplayServer** button for that Layer.
d. In the **Sharing** section, you can see a list of images, and right next to those images, URLs for each of the images. Copy one of the URLs, for example, for the **Coresight Button Image.**



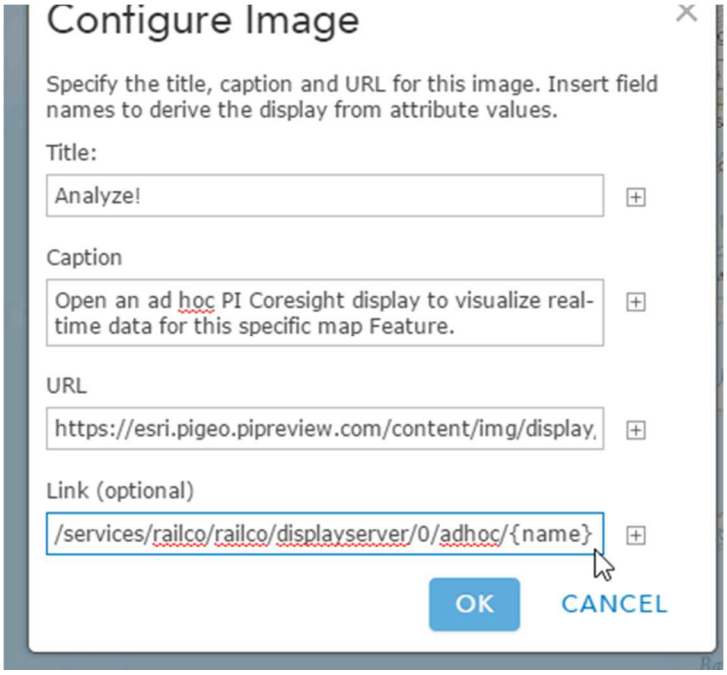
e. Back on your ArcGIS Online map, paste that URL in the **URL** Field in the Esri Configure Image window.


Configure Image
Specify the title, caption and URL for this image. Insert field names to derive the display from attribute values.
Title:
Analyze!
Caption
Open an ad hoc PI Coresight display to visualize real-time data for this specific map Feature.
URL
https://esri.pigeo.pipreview.com/content/img/display,
Link (optional)
OK
CANCEL

f. In the **Link** Field, we will enter the link to the DisplayServer endpoint, using the same URL that appears in the Ad hoc display Field in the Integrator Application Server. Back in the Integrator Application Server, for the corresponding Layer, under the **DisplayServer** tab, you can see a URL for **Ad hoc display**.



g. Copy that URL and, back on your map, paste it into the **Link** Field on the Esri Configure Image window, then click **OK**.



Now, you should click on a map Feature, and you'll see a pop-up appear, and scrolling down through the pop-up, you'll see the PI Coresight image that you selected. Clicking that image in the pop-up will open a link to your new PI Coresight display for that specific map Feature (you'll have to sign in with your AD credentials in order to access PI Coresight).

Repeat these steps for both Layers on your map, and test that you can successfully click on a Feature to open its pop-up, then click on the PI Coresight image button, and that a new PI Coresight display properly opens with data for that specific Feature.

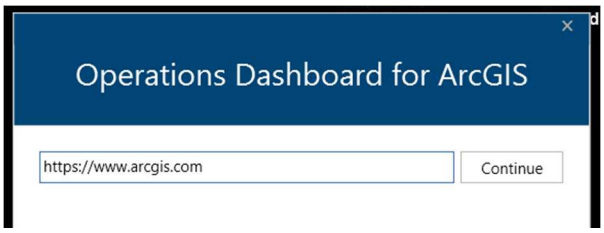
7. Create an Operations View dashboard around that Web Map

You've finally created a map that has a pair of live updating Layers on it, and you've configured that map to have PI Coresight integration, along with generally improving the look and feel of the pop-up and map. Now we're going to use Esri's Operations Dashboard client tool, a free dashboard building client that lets us augment this Web Map with Widgets and powerful analysis Features. We've already downloaded and installed Operations Dashboard for you; all you need to do now is sign in and start building!

First, let's create a simple Operations View.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

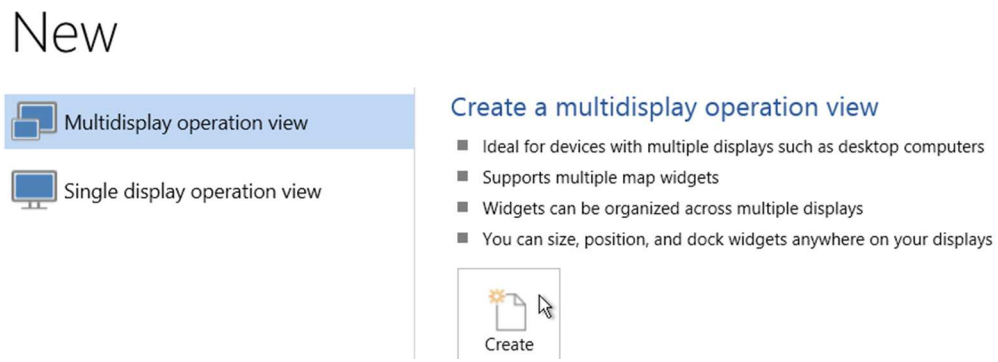
1. Launch Operations Dashboard. When it loads, it'll prompt you for a URL; here is where you can connect to a dedicated ArcGIS server, but in our case, we'll just leave the default value in place, and we'll click **Continue**.



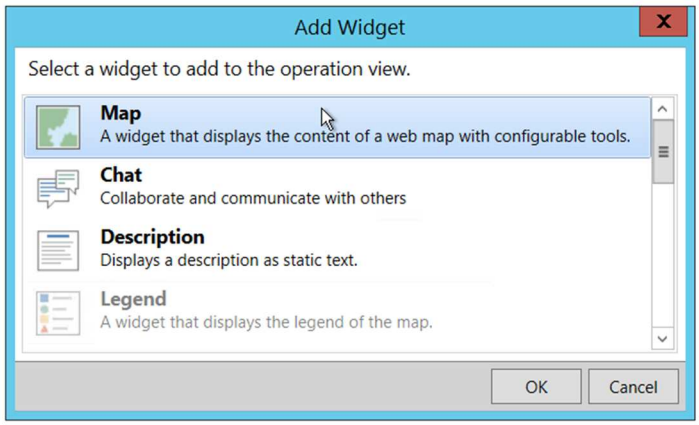
2. Enter in your individual ArcGIS Online credentials, then click **SIGN IN**; this will grant you access to the Web Map that you just created using that same ArcGIS Online account.

3. On the left-hand menu, click the option to **Create a New Operation View**.

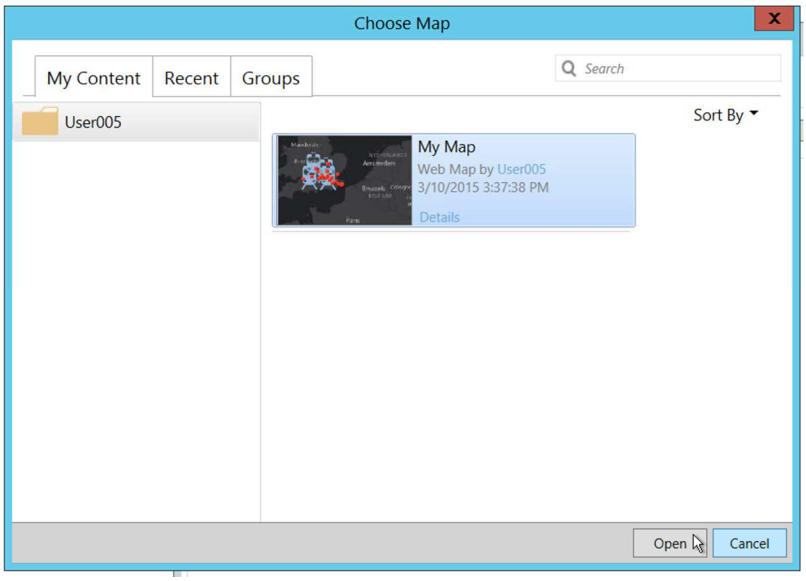
4. You are given the choice of a **Multidisplay operation view**, which supports greater flexibility and Widget options, or a **Single display operation view**, which is more limited, but which can be opened in a web browser. We'll chose **Multidisplay operation view**, since it allows us to use the custom PI Coresight Widget. After selecting that option, click **Create**.


New
Multidisplay operation view
Single display operation view
Create a multidisplay operation view
Ideal for devices with multiple displays such as desktop computers
Supports multiple map widgets
Widgets can be organized across multiple displays
You can size, position, and dock widgets anywhere on your displays
Create

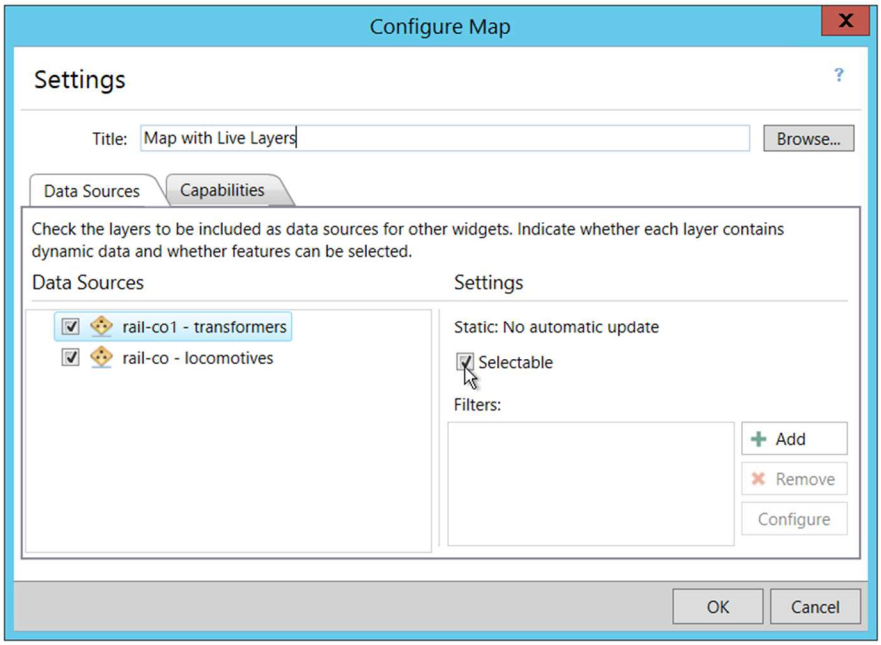
5. We want our dashboard to be centered on a Map, so in the Add Widget dialog that appears, where we can select the first Widget for our dashboard, click the **Map** Widget, and click **OK**.


Add Widget
Select a widget to add to the operation view.
Map
A widget that displays the content of a web map with configurable tools.
Chat
Collaborate and communicate with others
Description
Displays a description as static text.
Legend
A widget that displays the legend of the map.
OK
Cancel

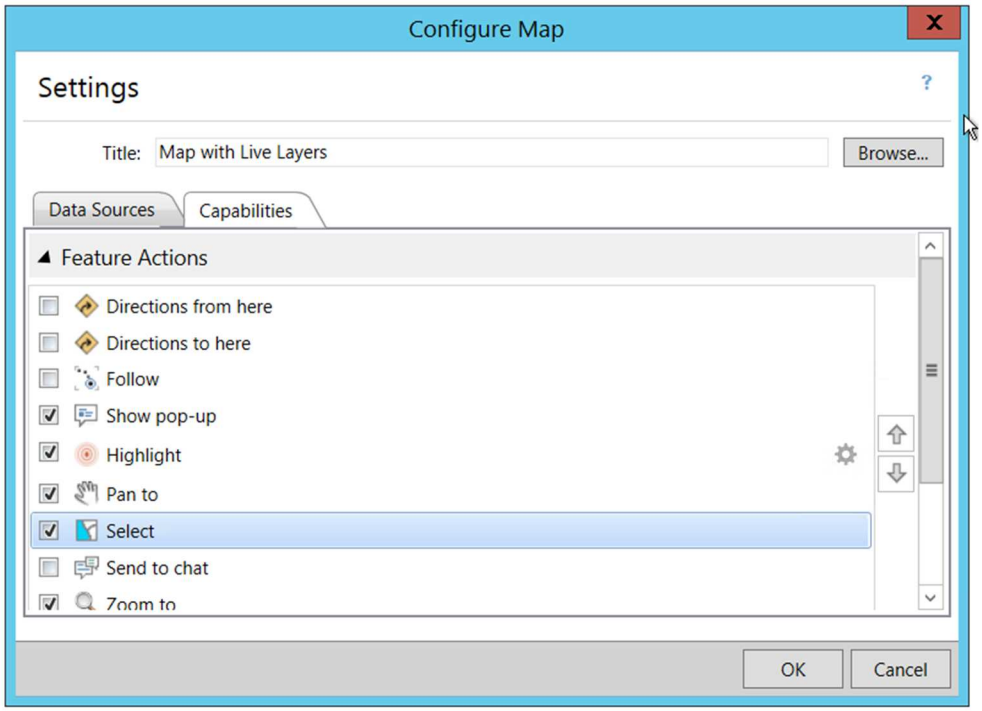
6. You can then see a screen where you can search through all of your maps to choose the one for this Widget; there shouldn't be too many to choose from. Select the map you created in section 5, then click **Open**.



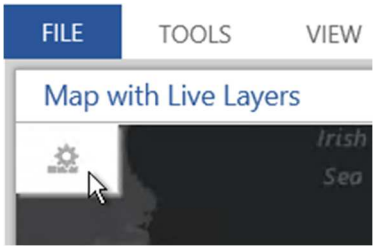
7. Give your map Widget a title; for example, "Map with Live Layers". You'll also see a list of Layers on the map, including the live Layers that we added. We want to use them as data sources for our Widgets, and we want to be able to do multi-select operations on them, so for both of your live Layers, check the **Data Sources** check box and the **Selectable** check box.



8. In the **Capabilities** tab, we can pick what actions we can perform for each Feature. Check the following capabilities, then click "OK":
    a. Show pop-up
    b. Highlight
    c. Pan to
    d. Select
    e. Zoom to
    f. Feature Pop-ups

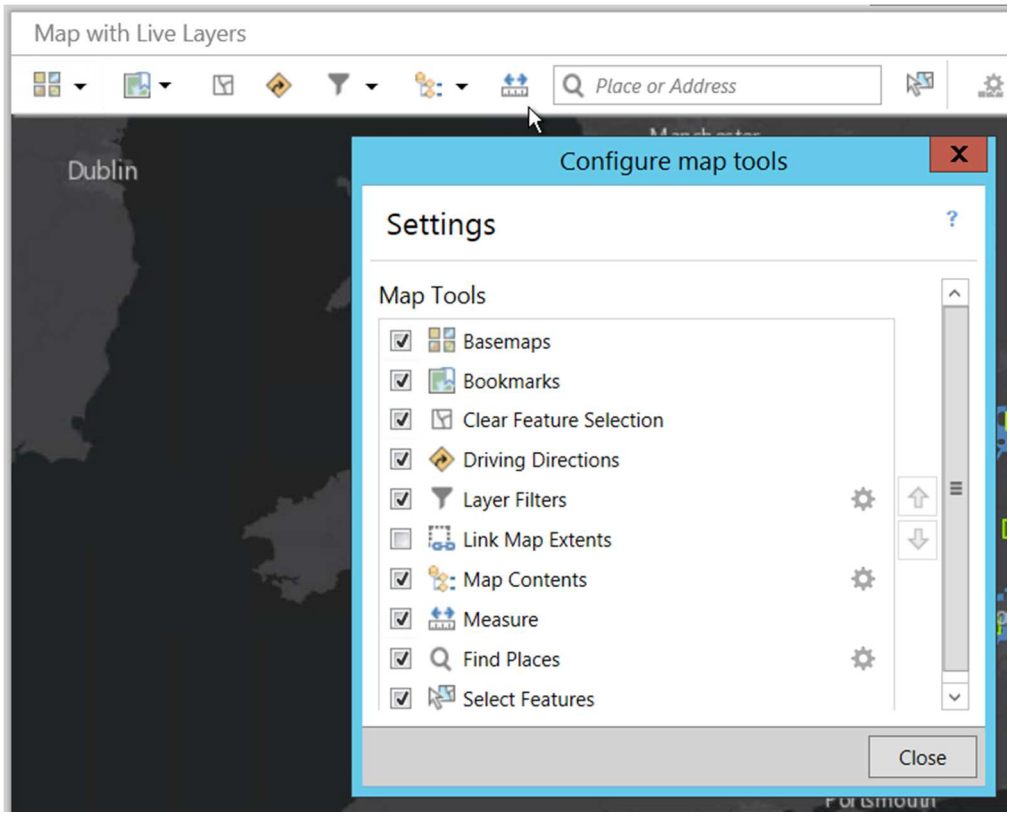


9. Your dashboard will be created, with a single map Widget in the middle that shows the Web Map you created in section 5. But it's lacking some of the tools that we saw in the ArcGIS Online Map viewer. In the top left of the map Widget, click on the **Map Tools** button, a little gear icon, to enable our familiar map tools.

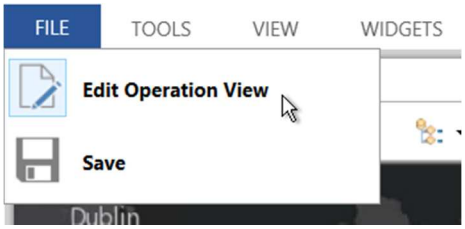


10. You'll see a list of several of the tools that we saw in ArcGIS Online; select all of them, except for **Link Map Extents**; that is only useful if you're using multiple maps, and we're only going to use a

single map Widget. When finished, click **Close**, and you'll now see that the top of your map Widget contains a toolbar of familiar tools.



11. Let's turn off edit mode. Click **Tools** > **Edit Operation View**, which will turn off edit mode; you'll see all the gear icon buttons disappear, which hides all the editable configuration settings.

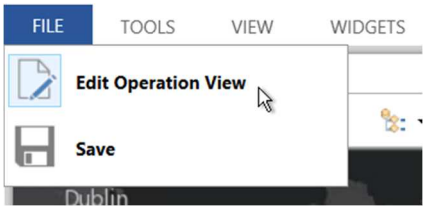


12. Having finished this, let's save our operation view. On the toolbar, click **File**. Enter in a name for your operation view, then scroll down and click **Save.**

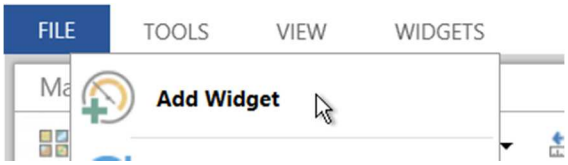
Now we have an operation view that looks very similar to what we had in ArcGIS Online; the next step is to actually add Widgets around the central map Widget, to make this much more of a dashboard. Once everyone has created and saved the basic dashboard, we'll all proceed together to add more Widgets. If you have time, you can explore how the dashboard operates; try clicking on a map Feature—you'll see a pop-up appear, just like in ArcGIS Online, and you can click on the PI Coresight image in that pop-up to be taken right to an ad hoc PI Coresight display, just like before.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

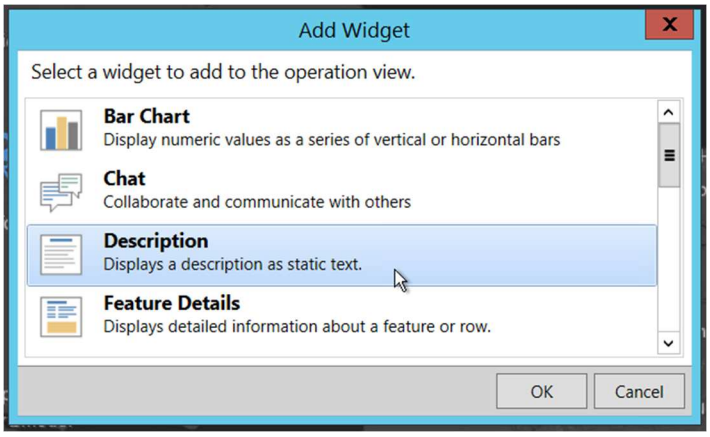
1. Turn on edit mode by clicking **Tools** > **Edit Operation View**.



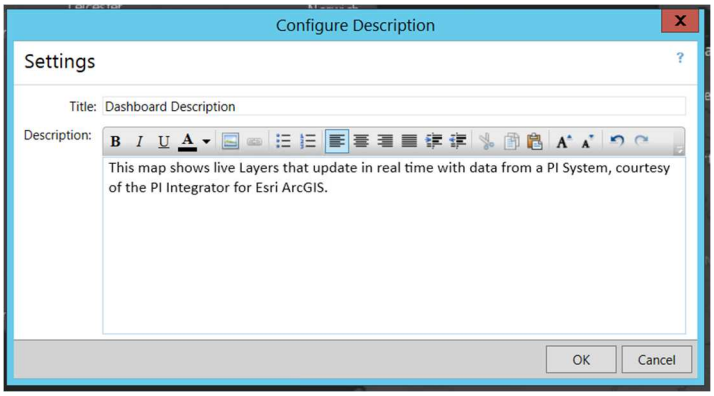
2. Let's add a description Widget below our map. Click **Widgets** > **Add Widget**, revealing the list of all possible Widgets.



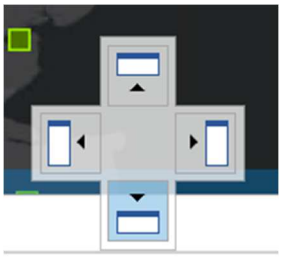
3. Scroll down through the list to the **Description** Widget, then click OK.


Add Widget
Select a widget to add to the operation view.
Bar Chart
Display numeric values as a series of vertical or horizontal bars
Chat
Collaborate and communicate with others
Description
Displays a description as static text.
Feature Details
Displays detailed information about a feature or row.
OK
Cancel

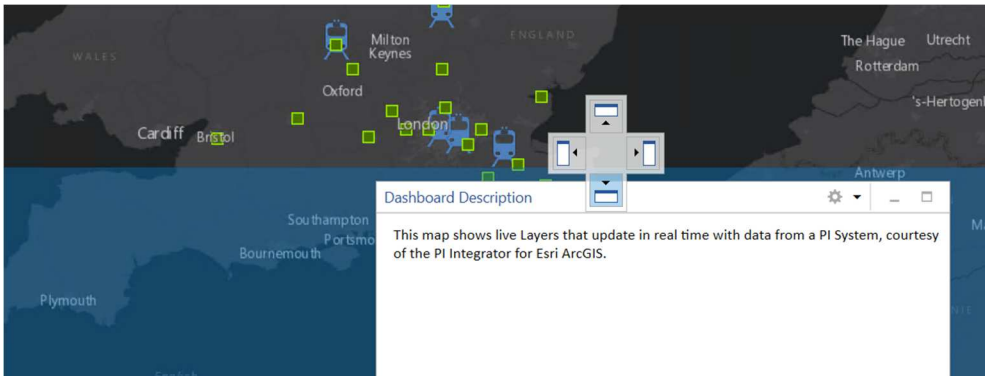
4. Enter in a **Title** and **Description**; for example, you can set the title to be "Dashboard Description", and for the description you can enter "This map shows live Layers that update in real time with data from a PI System, courtesy of the PI Integrator for Esri ArcGIS.". When done, click **OK**.


Configure Description
Settings
Title: Dashboard Description
Description:
This map shows live Layers that update in real time with data from a PI System, courtesy of the PI Integrator for Esri ArcGIS.
OK
Cancel

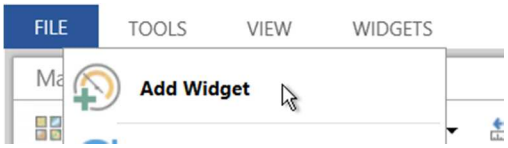
5. You can now dock this Widget to a location on the dashboard. Click and hold on its title bar, and drag it down; you'll see four positioning buttons appear.



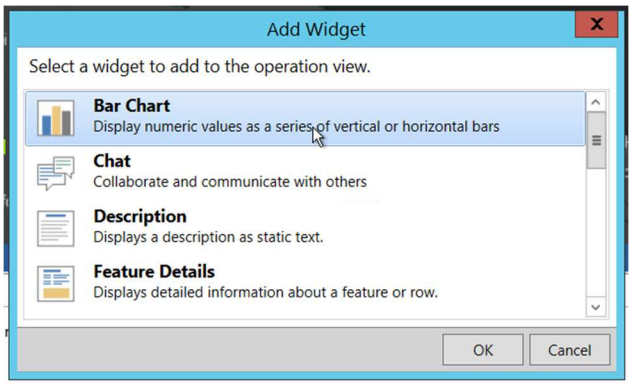
The buttons indicate that you can dock this Widget above, below, or to the right or left of the underlying map Widget. Drag the Widget onto the bottom position button, and you'll see a blue area become highlighted where the Widget will dock. Release the mouse button, and the Widget will dock to that location. You can then click on the boundary between it and the map Widget to resize this new Widget.



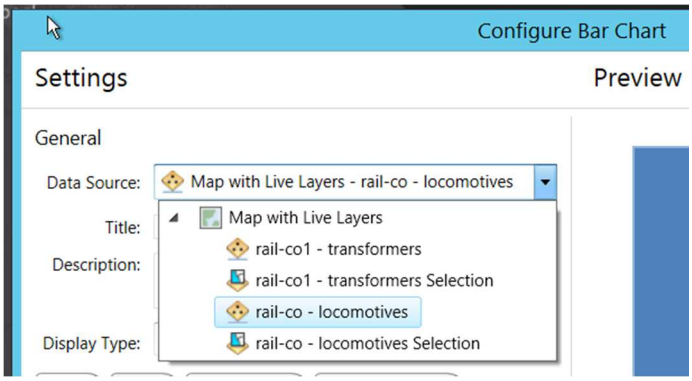
6. Let's add a bar chart Widget. Again, click **Widgets** > **Add Widget**, revealing the list of all possible Widgets.



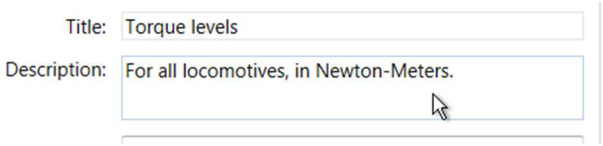
7. Scroll down through the list to the **Bar Chart** Widget, then click OK.


Add Widget
Select a widget to add to the operation view.
Bar Chart
Display numeric values as a series of vertical or horizontal bars
Chat
Collaborate and communicate with others
Description
Displays a description as static text.
Feature Details
Displays detailed information about a feature or row.
OK
Cancel

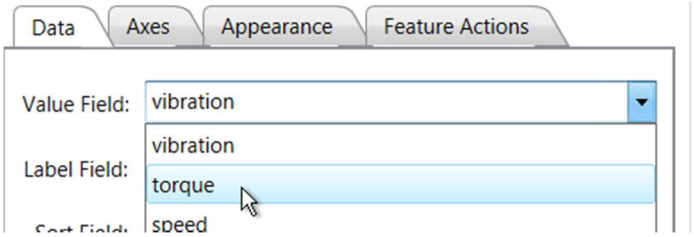
8. Use the **Data Source** drop-down to select the data source for this Widget; for example, pick the mobile assets (locomotives) Layer.



9. Enter in a **Title** and **Description**; for example, you can set the title to be "Torque levels".

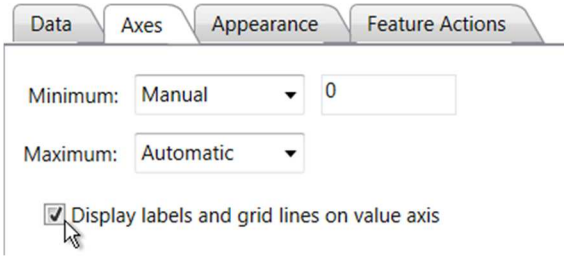


10. In the **Value Field** drop-down, select the Field (which corresponds to an AF Attribute) that you wish to graph; in our case, select **Torque**.

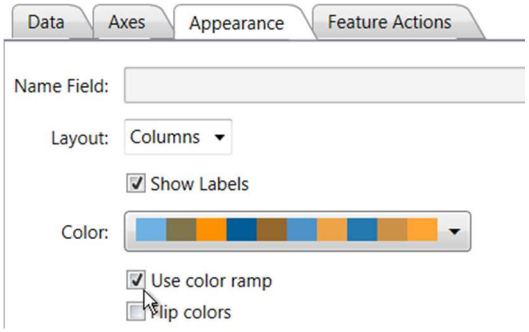


11. In the **Label Field** and **Sort Field**, select that you want to use **Name**.

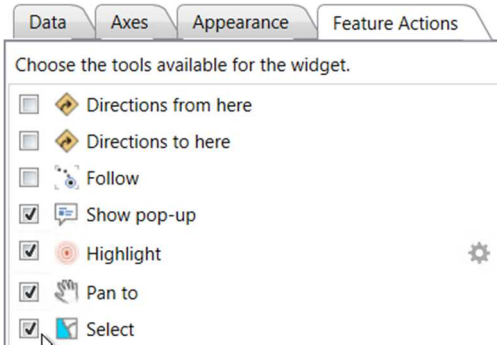
12. On the **Axes** tab, check the box to **Display labels and grid lines on value axis**.



13. On the **Appearance** tab, check the **Show Labels** box and the **Use color ramp** box.



14. Finally, to allow the user to interact with the chart, on the **Feature Actions** tab, check the boxes for the following:
    a. **Show pop-up**
    b. **Highlight**
    c. **Pan to**
    d. **Select**

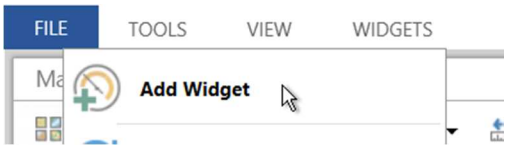


15. Click **OK**. Just like before, you can now dock this Widget to a location on the dashboard. Click and hold on its title bar, and drag it to the left; you'll see four positioning buttons appear, indicating that you can dock this Widget above, below, or to the right or left of the underlying map Widget. Drag the Widget onto the left position button this time, and you'll again see a blue area become highlighted where the Widget will dock. Release the mouse button, and the Widget will dock to that location. You can then click on the boundary between it and the map Widget to resize the newly docked Widget.

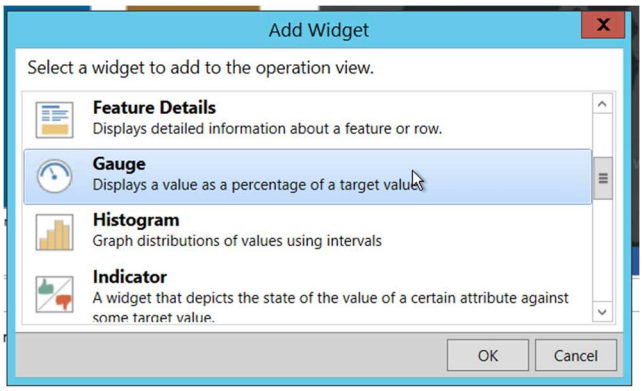
Thus far, we've created a fairly traditional dashboard, but now let's add some Widgets that allow us to do some geo-spatial analysis right in the dashboard—for example, to answer questions that are dependent on the location of the assets on the map.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

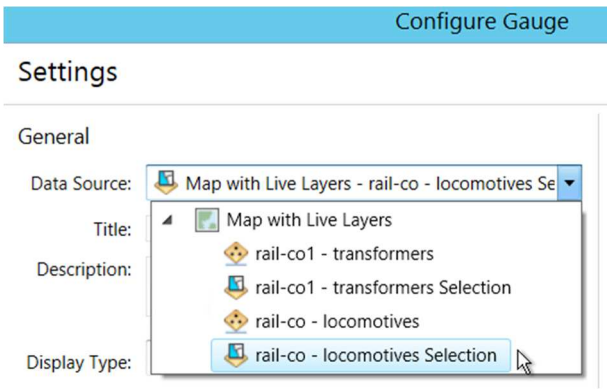
1. Let's add a gauge Widget below our map. Click **Widgets** > **Add Widget**, revealing the list of all possible Widgets.



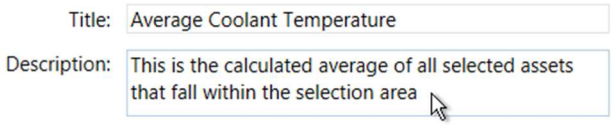
2. Scroll down through the list to the **Gauge** Widget, then click OK.


Add Widget
Select a widget to add to the operation view.
Feature Details
Displays detailed information about a feature or row.
Gauge
Displays a value as a percentage of a target value
Histogram
Graph distributions of values using intervals
Indicator
A widget that depicts the state of the value of a certain attribute against some target value.
OK
Cancel

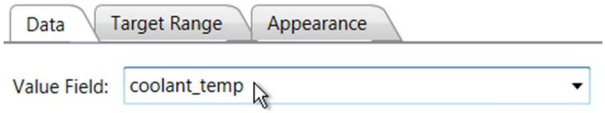
3. Select the **Data Source** for this Widget; in this case, since we'll be selecting subgroups of assets, we'll choose the mobile assets Layer that ends in "**- Selection**", which means this Widget will only operate on data for selected Features.



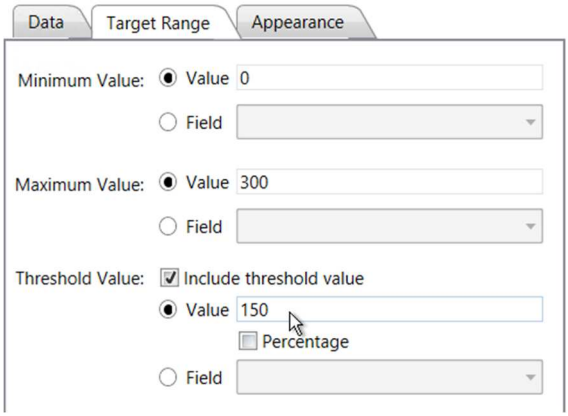
4. Enter in a **Title** and **Description**; for example, you can set the title to be "Average Coolant Temperature", and for the description you can enter "This is the calculated average of all selected assets that fall within the selection area".


Title:
Average Coolant Temperature
Description:
This is the calculated average of all selected assets that fall within the selection area

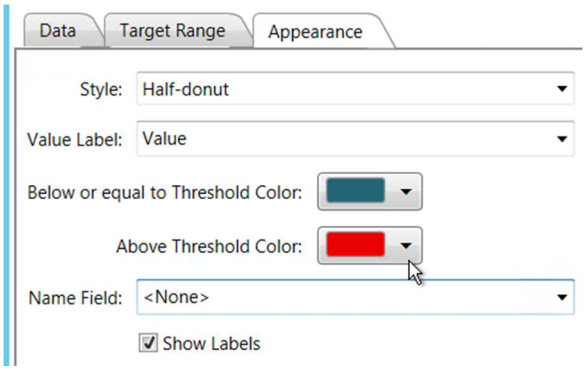
5. In the **Value Field** drop-down, select the Field (which corresponds to an AF Attribute) that you wish to graph; in our case, select **Coolant temperature**. Leaver everything else as is.



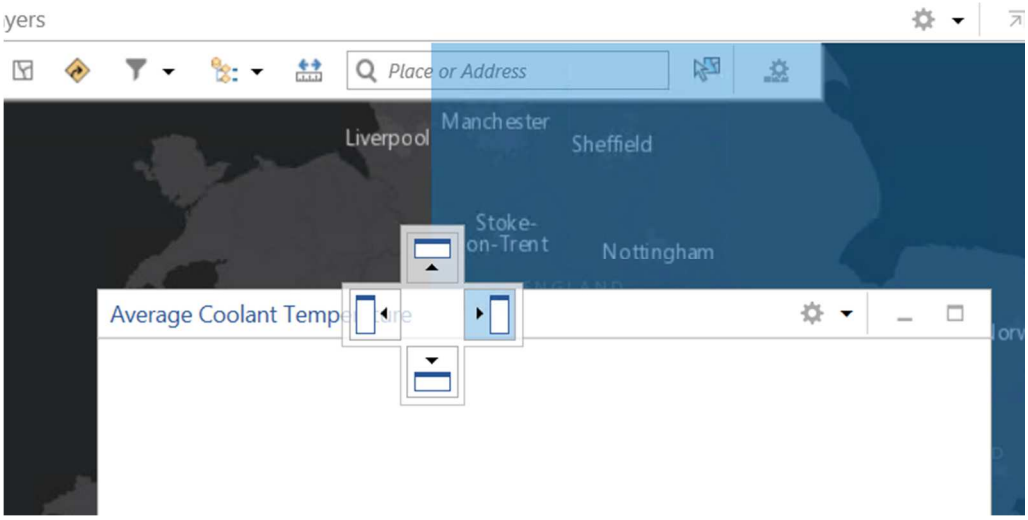
6. Under the **Target Range** tab, enter a **Maximum Value** of **300**. Also check the box for **Include threshold value**, and specify a threshold of **150**.



7. Under the **Appearance** tab, click the **Show labels** check box, and choose a pair of interesting colors for the **Below** and **Above Threshold** colors. Leave everything else as is.

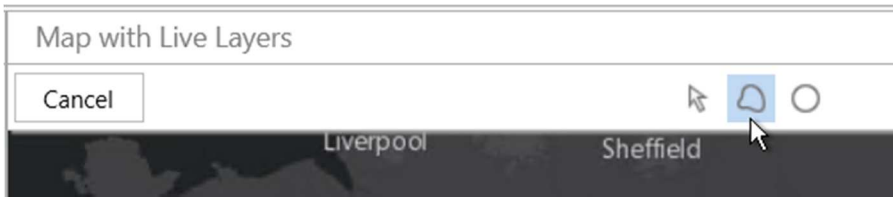


8. Now that you're done, click **OK**. Just like before, you can now dock this Widget to a location on the dashboard. Click and hold on its title bar, and drag it to the right; you'll see four positioning buttons appear, indicating that you can dock this Widget above, below, or to the right or left of the underlying map Widget. Drag the Widget onto the right position button this time, and you'll again see a blue area become highlighted where the Widget will dock. Release the mouse button, and the Widget will dock to that location. You can then click on the boundary between it and the map Widget to resize the newly docked Widget.

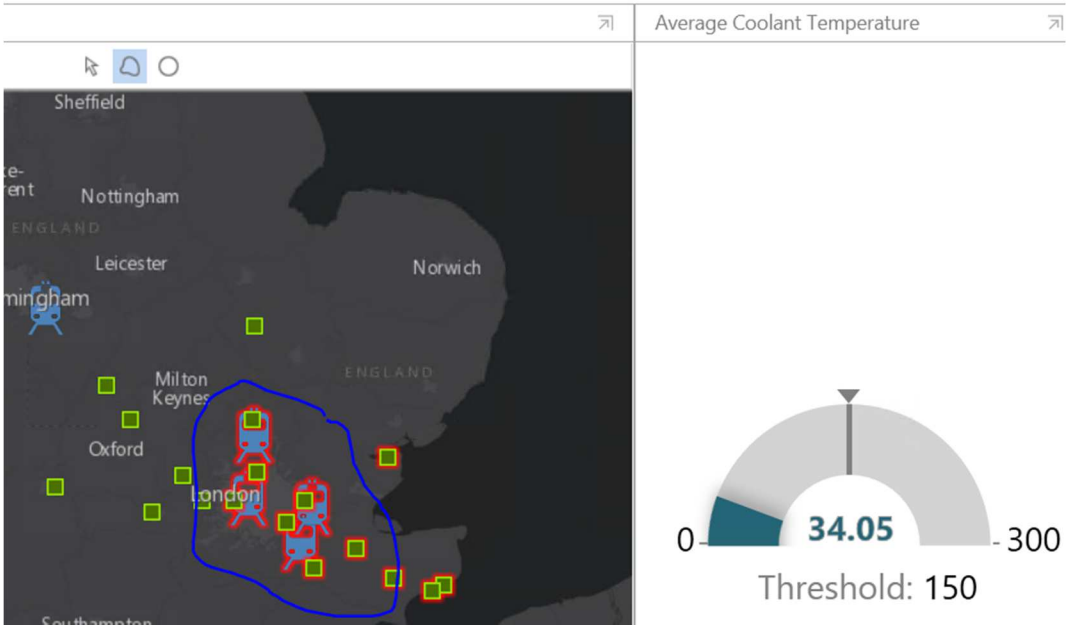


9. Now let's use this Widget to answer a geo-spatial question. Imagine if someone asked you to calculate the average coolant temperature of all assets in the southeast corner of the map. That'd be a very hard PI calculation—because you would somehow have to calculate the position using the latitude and longitude, and compare it to the boundary, and so on and so on… and what if the boundary changes?! But it's very easy to answer here! To get started, on the top map toolbar, select the **Select Features** button; it's the one with a mouse pointer arrow in it.

10. You now have three choices for how to draw a selection window. Select the middle button to choose a free-form selection.



11. Click and hold on the map, and draw a selection area around assets in the south-east area of the map. You'll see that the value in your Widget changes depending on which Feature you select, or which group of Features you select.



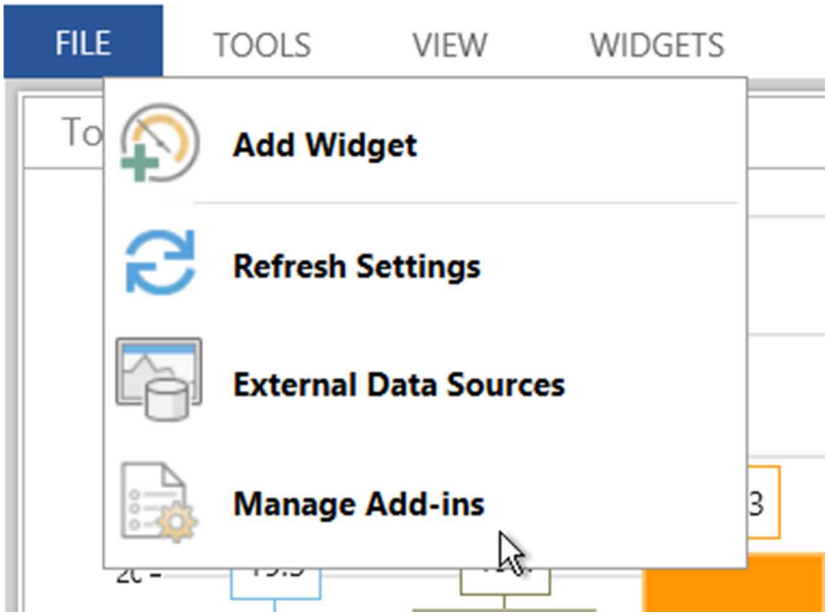
12. Repeat steps 1 through 11 for your second Layer, for the static assets; follow the same steps to create a gauge Widget, only in this case, pick a different Field to calculate (for example, the **current** Field). Remember that when creating your Widget, specify that the **Data Source** is the Layer that corresponds to your static assets, and specifically, make sure that you've selected the Layer that ends in "**-Selection**".
13. That's it! Turn off edit mode, and save your operation view. Feel free to explore the dashboard you've created, or try out adding new or additional Widgets. Well done!

"EXTRA CREDIT"

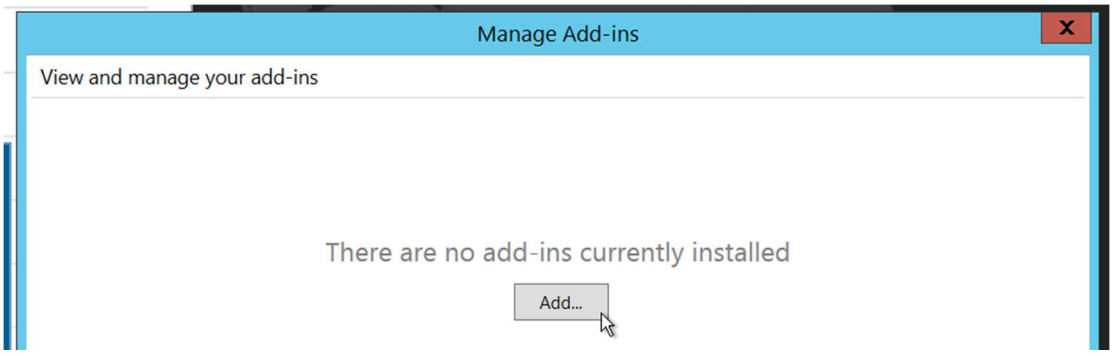
It's actually possible to add a second level of PI Coresight integration; you can add a PI Coresight Widget to the dashboard as well, though a custom Widget, to let you see a PI Coresight display right alongside your map.

After being instructed to begin, you will complete these steps on your own. This class is a great chance to ask any and all questions that you have along the way, so please do raise a hand to signal an instructor--we're glad to help.

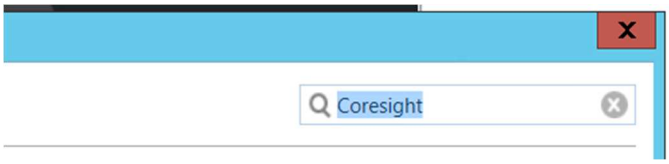
1. With edit mode back on, click **Widgets** > **Manage Add-Ins** to begin to add the new Widget.



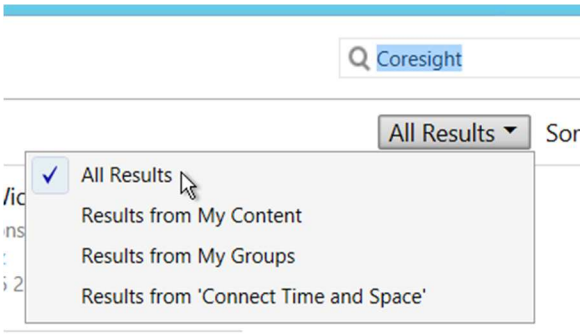
2. Click the **Add…** button to add a new add-in, since none are currently installed.



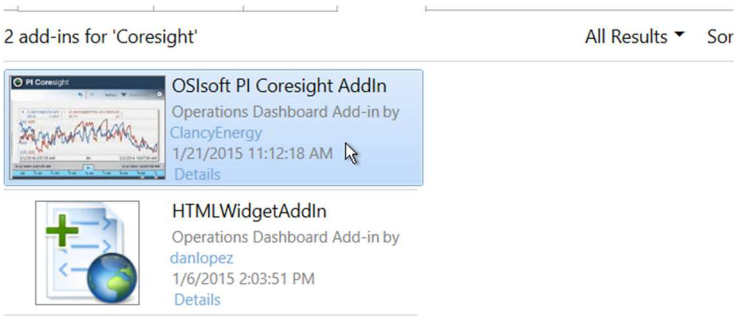
3. In the search box in the top right, type “Coresight”, and hit enter.



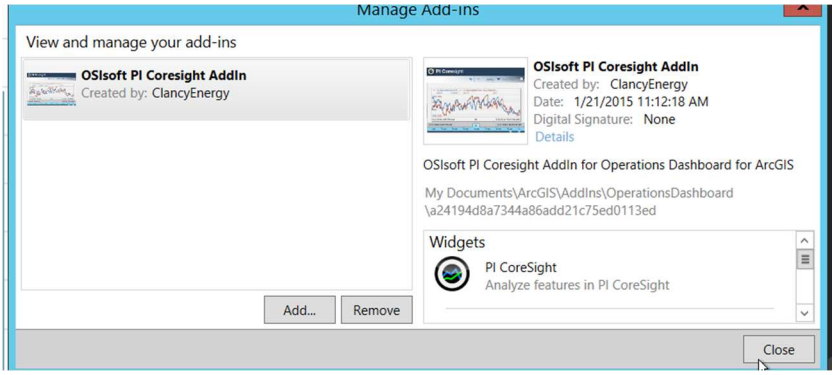
4. Under the **Results** drop-down below the search box, choose **All Results**.



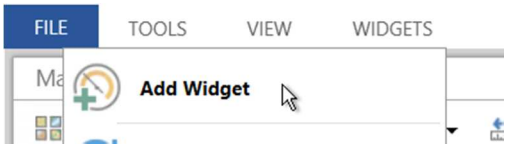
5. You should see the **OSIsoft PI Coresight AddIn**; click on it, and then click **Open**.



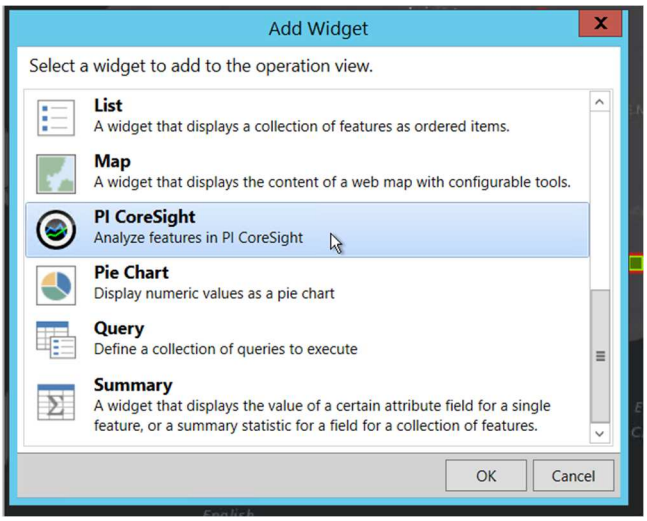
6. You should now see that the **OSIsoft PI Coresight AddIn** is listed in your list of add-ins. Click **Close**.



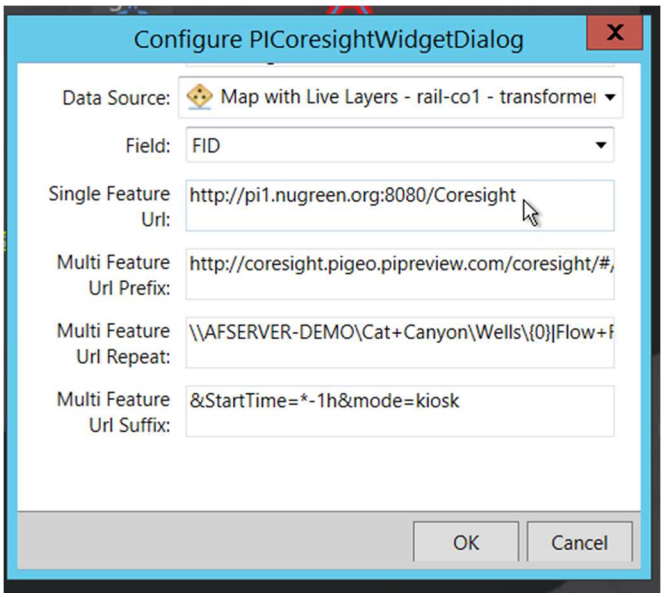
7. Click **Widgets** > **Add Widget**, revealing the list of all possible Widgets, including your new one.



8. Scroll down through the list to the **PI Coresight** Widget, then click OK.


Add Widget
Select a widget to add to the operation view.
List
A widget that displays a collection of features as ordered items.
Map
A widget that displays the content of a web map with configurable tools.
PI CoreSight
Analyze features in PI CoreSight
Pie Chart
Display numeric values as a pie chart
Query
Define a collection of queries to execute
Summary
A widget that displays the value of a certain attribute field for a single feature, or a summary statistic for a field for a collection of features.
OK
Cancel

9. In the **Single Feature Url** Field, paste in the URL for PI Coresight (http://pi1.nugreen.org:8080/Coresight) then click **OK**. You can ignore all of the other fields, for now.



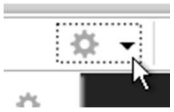
10. You'll see that PI Coresight display opens right in the Widget! You can thus dock this Widget right where you want it, just like you docked the others. And for more powerful Features of this Widget, if you have time, feel free to approach an instructor.

    For example, you could create a PI Coresight display, save it, and then paste in the display for that particular URL into the **Single Feature Url** Field, so that you will always see that particular display alongside your map.

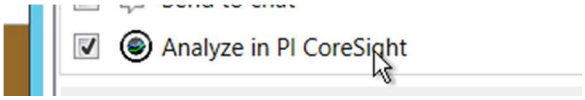
    Additionally, you can also use this Widget to open ad-hoc PI Coresight displays depending on the selected map Feature. The Feature pop-up link image that you added earlier allows you to launch PI Coresight displays in a new browser window, but this new PI Coresight Widget allows you to open ad hoc PI Coresight displays within the Widget, so the user never has to leave Operations Dashboard.

    Brief instructions:

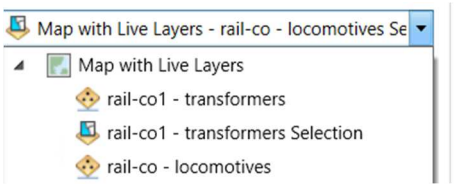
    1. While in **Edit Mode**, open **Configure Map** by clicking the top-right gear icon.

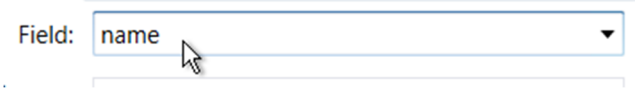
    2. Under the **Capabilities** tab, check the box for the **Analyze in PI Coresight** Feature Action, then click **OK.**

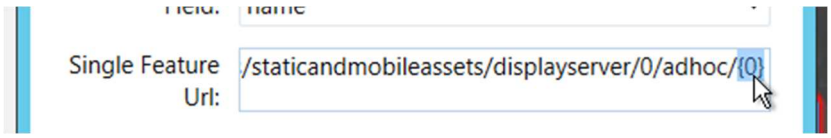
    3. Open the settings for your PI Coresight Widget (click its gear icon), and in the **Data Source** Field, select a non-selection data source, such as **locomotives**.

    
    Map with Live Layers - rail-co - locomotives Se
Map with Live Layers
rail-co1 - transformers
rail-co1 - transformers Selection
rail-co - locomotives

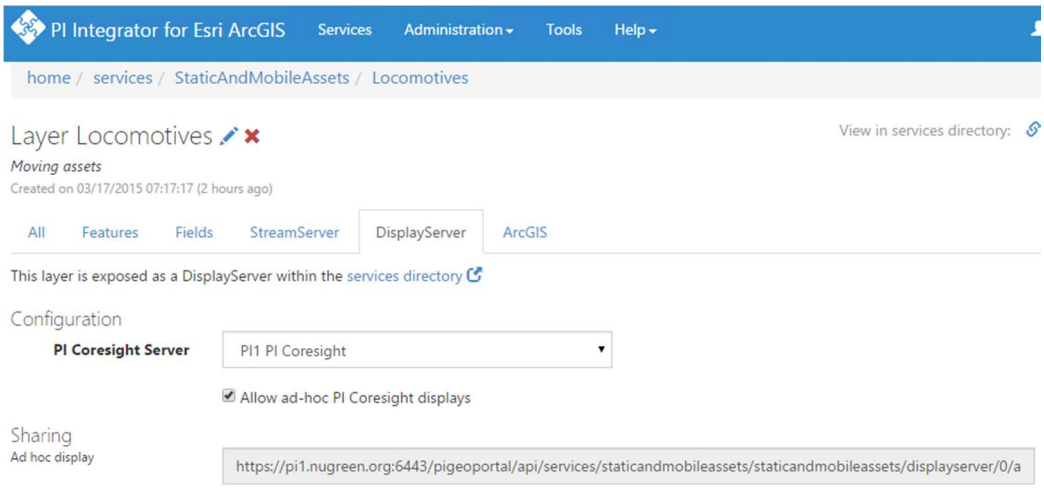
    4. To identify the Features, specify that the **Field** drop-down will be **name**.

5. In the **Single Feature Url** field, paste in the same DisplayServer link that you used when setting up your pop-up image in ArcGIS online; at the end of the URL, replace **{name}** with **{0}**.

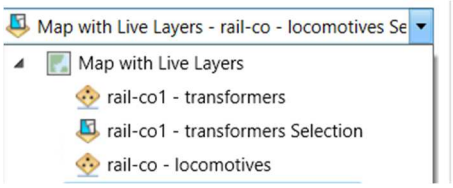


You can find this link, the **Ad hoc display** link, from the Integrator Application Server, under the Layer that corresponds to the data source that you selected above in step 3.

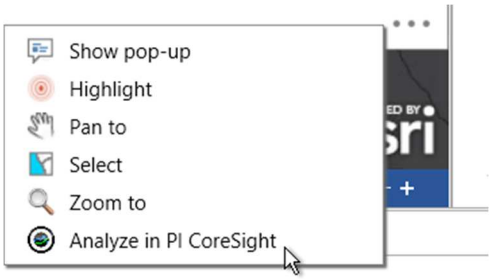


When done, click **OK** to finish editing your Widget.

6. Now, click on a map Feature in the Layer that you specified as the data source in step 3; for example, if you specified that the data source was **locomotives**, click a locomotive Feature.

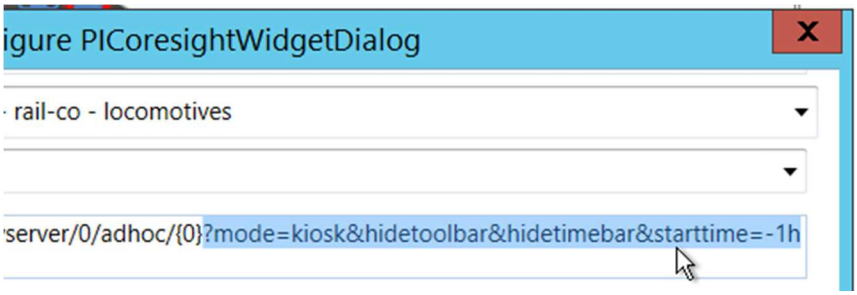

Map with Live Layers - rail-co - locomotives Se
Map with Live Layers
rail-co1 - transformers
rail-co1 - transformers Selection
rail-co - locomotives

7. Click the ellipsis button in the Feature pop-up bottom right, which will list available Feature Actions, which should now include **Analyze in PI Coresight**. Click it.



8. An ad hoc display for that specific clicked map Feature should show up in the PI Coresight widget! For example, if you clicked on Locomotive 14001, you should see an ad hoc display for Locomotive 14001.

9. As final adjustments, you can open the Widget again and append control parameters to the URL, for example, to force it to be in Kiosk mode (*mode=kiosk*), to change the start and end time, or to hide the toolbar (*hidetoolbar*) or time bar (*hidetimebar*). These are the last steps; after this, you're done! Remember to **Save**!



Conclusion

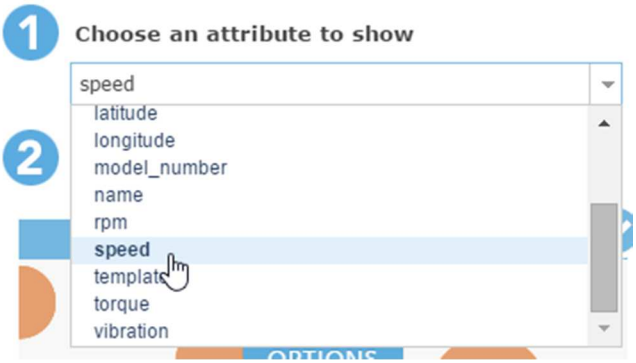
Congratulations! You've just created a dashboard that shows locations of assets, a bar chart of their live values, and contains Widgets that allow you to perform geospatial calculations on-the fly, calculations that wouldn't be possible with the standard OSIsoft tools. And you can still click on Feature pop-ups to open PI Coresight displays for each map Features!

We've covered a lot together, from the PI Integrator for ArcGIS, to the Esri GeoEvent Extension, to ArcGIS Online, and now finally Operations Dashboard. It's been quite a lot--thanks for your attention and participation. If you've any questions, feel free to bring them up with your instructors—we'd be glad to help. And if ever have any future questions, remember to consult the handy OSIsoft Live Library, available for anyone, for free, at anyone at livelibrary.osisoft.com; click the "Integrators" section to see the full user manual for the PI Integrator for Esri ArcGIS.

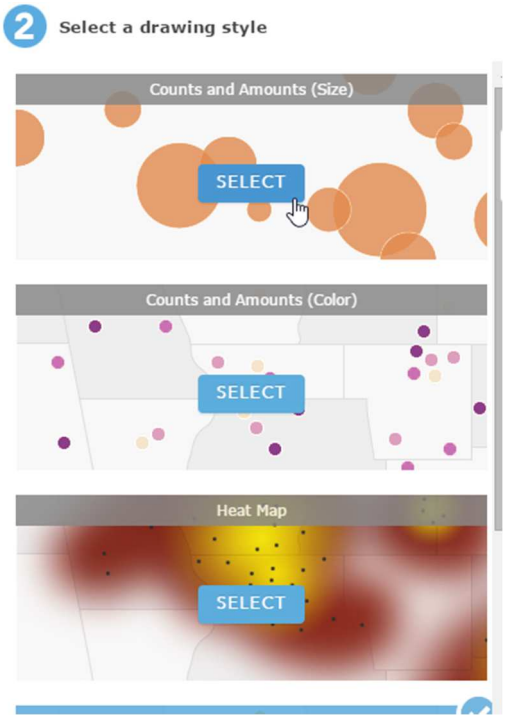
Appendix

Additional notes for section **5. Create an ArcGIS Online Web Map to display the new Feature Service**:

When changing the symbology for a Layer in ArcGIS Online, you can also select that you want to have unique symbols for each Feature. After opening the drop-down for a Layer, and after clicking **Change Style**, you can, in new drop-down that appears, choose that you want the symbology to be determined by a specific Field. For example, you can choose **Speed.**

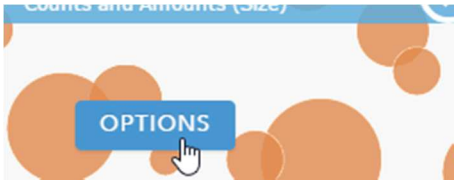


Now you can either select that you want the symbol size to vary based on the value of **Speed**, or you can select that you want the symbol color to vary based on the value of **Speed**, or you could create a heat map:

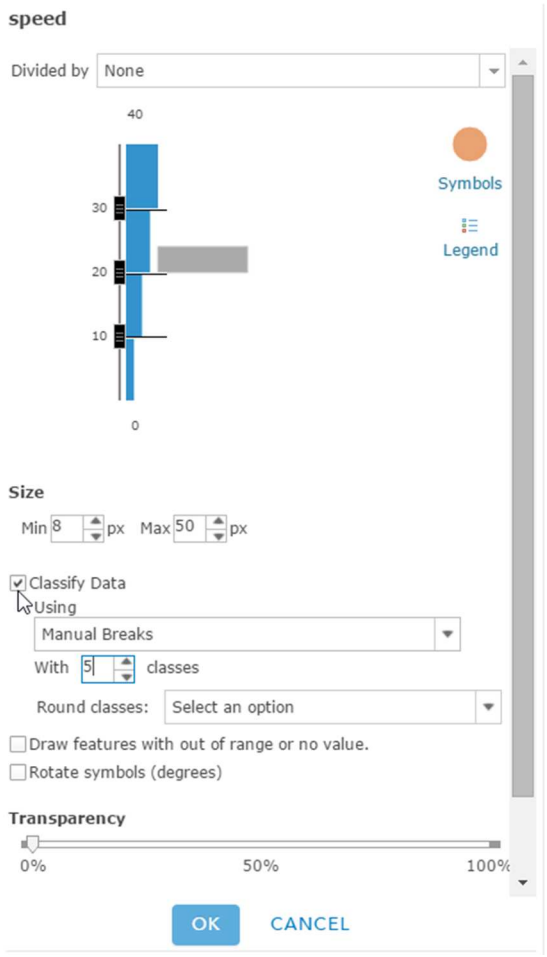


You can also choose to vary the symbols by **Size** or **Color** for each Feature.

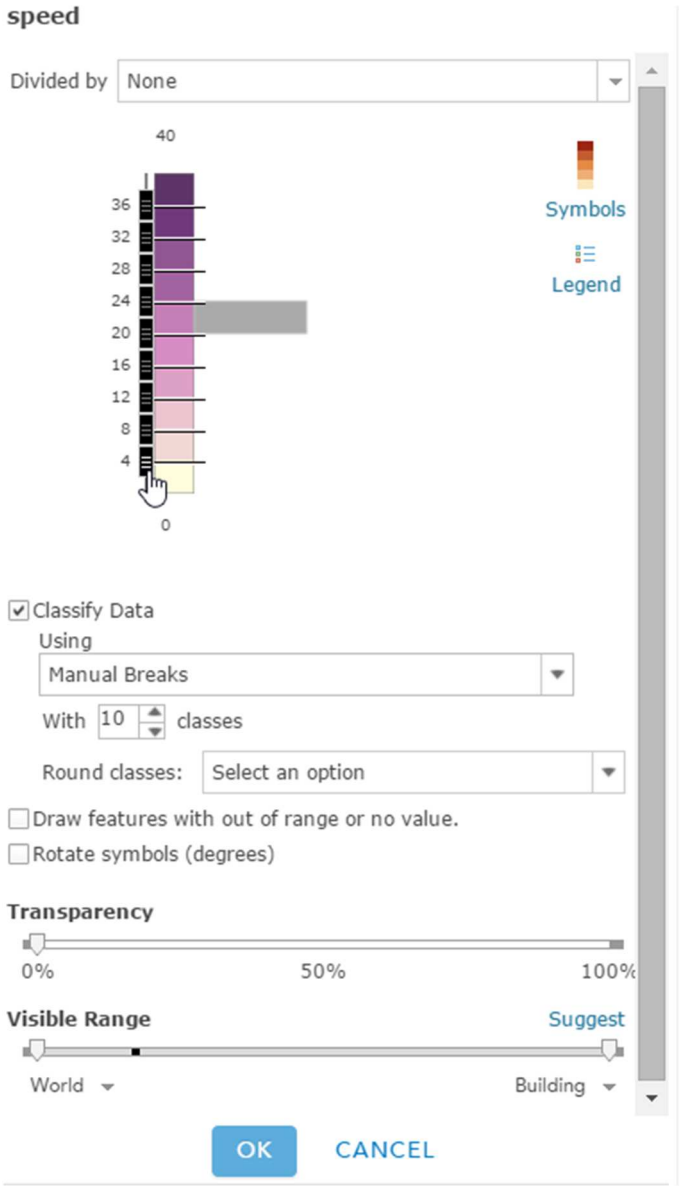
The first two options work similarly; after specifying **Size**, for example, you can click the **Options** button to configure how the symbol sizes will be scaled.



You can divide the Field values by another field, if you wish, you can change the start and ending symbol size, and more. You can also click on the **Symbols** link to change which symbol will be used by this layer, which will open the same dialog box that we saw earlier. Very importantly, you can click **Classify Data**, and select **Manual Breaks** to choose which range of Field values will be mapped to which symbol.



On the other hand, you could also select that you want to change the symbol color, in which case you could click on **Options** and see a different configuration pane:



You can change the theme, basically changing the gradient shape and pattern, you can change the range that is used, and just like before, you can click **Classify Data**, and select **Manual Breaks** to choose which range of Field values will be mapped to which symbol. You can also click **Symbols** to change the colors used in the gradient.

After this, remember to save your map!

OSIsoft Virtual Learning Environment

"The ArcGIS Online Organization subscription configured in this lab has expired. However you can work on this lab using your own organization in ArcGIS Online. If you are not a member of an existing organization, you can get a 60 day free trial: http://www.arcgis.com/features/free-trial.html?origin=arcgis"

The OSIsoft Virtual Environment provides you with virtual machines where you can complete the exercises contained in this workbook. After you launch the Virtual Learning Environment, you will have to connect to **PI1 and GEP1** to complete different parts of the lab with the username **nugreen\pisandboxadmin,** and password **0nc3Inawhil3!**

The environment contains the following machines:

GEP1: the ESRI ARCGIS server.

PI1: a windows server that runs the PI System and that contains all the software and configuration necessary to perform the exercises on this workbook. This is one the machines you need to connect to.

DC1: a domain controller that provides network and authentication functions.

The system will create these machines for you upon request and this process may take between 5 to 10 minutes. During that time you can start reading the workbook to understand what you will be doing in the machine.

After you launch the virtual learning environment your session will run for up to 8 hours, after which your session will be deleted. You can save your work by using a cloud storage solution like onedrive or box. From the virtual learning environment you can access any of these cloud solutions and upload the files you are interested in saving.

System requirements: the Virtual Learning Environment is composed of virtual machines hosted on Microsoft Azure that you can access remotely. In order to access these virtual machines you need a Remote Desktop Protocol (RDP) Client and you will also need to be able to access the domain cloudapp.net where the machines are hosted. A typical connection string has the form cloudservicename.cloudapp.net:xxxxx, where the cloud service name is specific to a group of virtual machines and xxxxx is a port in the range 41952-65535. Therefore users connecting to Azure virtual machines must be allowed to connect to the domain *.cloudapp.net throughout the port range 41952-65535. If you cannot connect, check your company firewall policies and ensure that you can connect to this domain on the required ports.